

America's Premier Aeronautical Magazine

AERO DIGEST

INCLUDING
AVIATION ENGINEERING

MARCH 1950 • ANNUAL DIGEST • \$1.00



Navy's long-range record holder,
Lockheed P2V Neptune patrol bomber,
with Hamilton Standard propellers.



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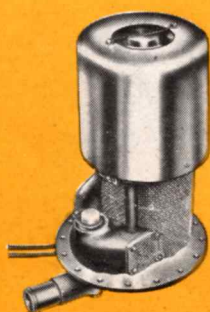
About our AIRCRAFT ACCESSORIES Division

THE PRODUCTS illustrated on this page are typical of a wide range of precision units manufactured by the Aircraft Accessories Division of our company at "Tapco".

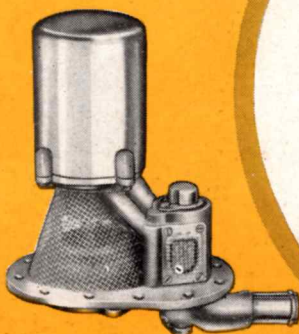
This division has specialized for years in the engineering and production of fuel systems for jet and piston-engine military planes, as well as commercial and personal aircraft of all types. It also designs and has unexcelled equipment for the production of the intricate compressor assemblies of steel, aluminum or magnesium, used for supercharging aircraft engines.

It is the largest peacetime manufacturer of these highly specialized products, and was the largest during the war.

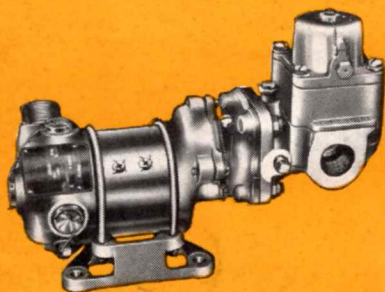
We invite engine and plane builders and commercial airline operators to use the development, testing and production facilities of our Aircraft Accessories Division.



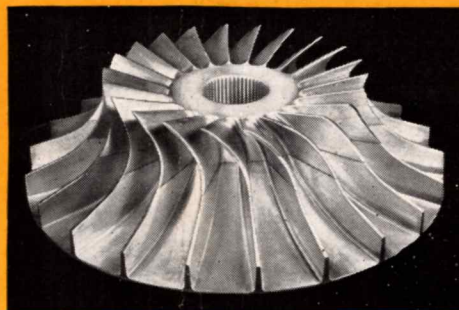
Submerged Centrifugal Type Fuel Booster Pump for Jet Aircraft.



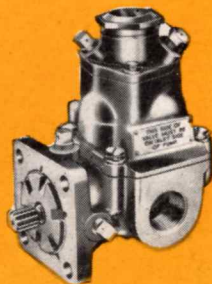
Submerged Centrifugal Type Fuel Booster Pump.



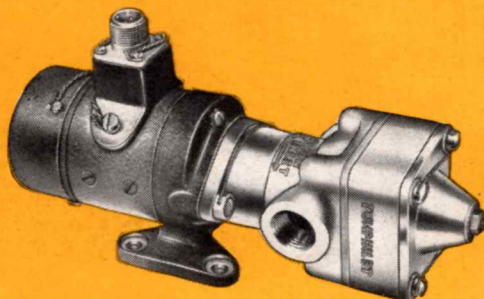
Electric Motor-Driven Fuel or Water Injection Pump.



Inducer-Impeller Assembly—Wright Cyclone 18 (R-3350)



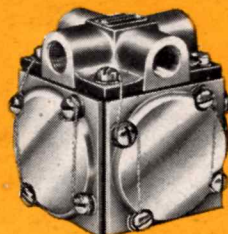
Engine-Driven Fuel or Water Injection Pump.



Engine or Motor-Driven Fuel Pump for Light Aircraft and Helicopters.



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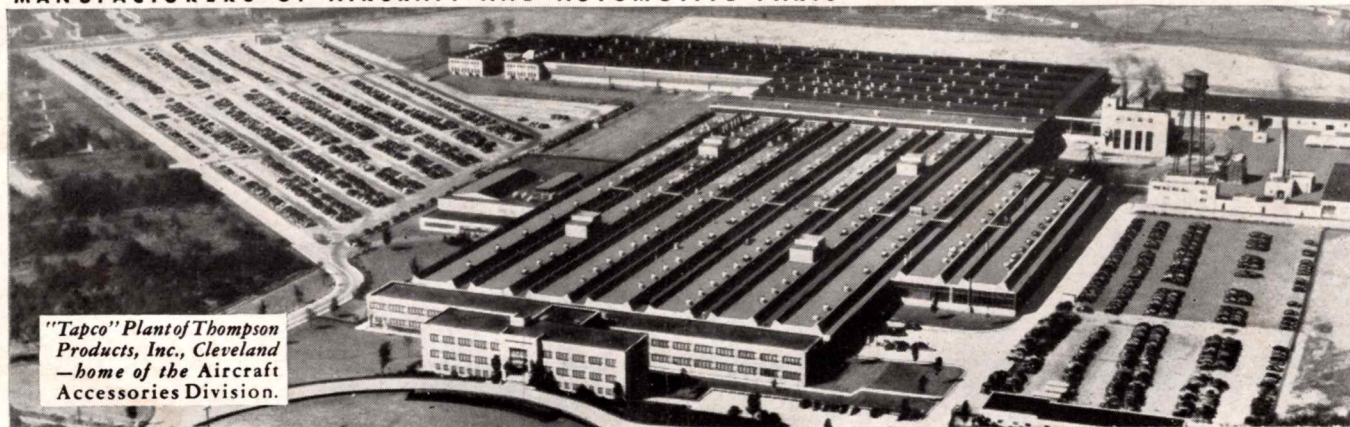
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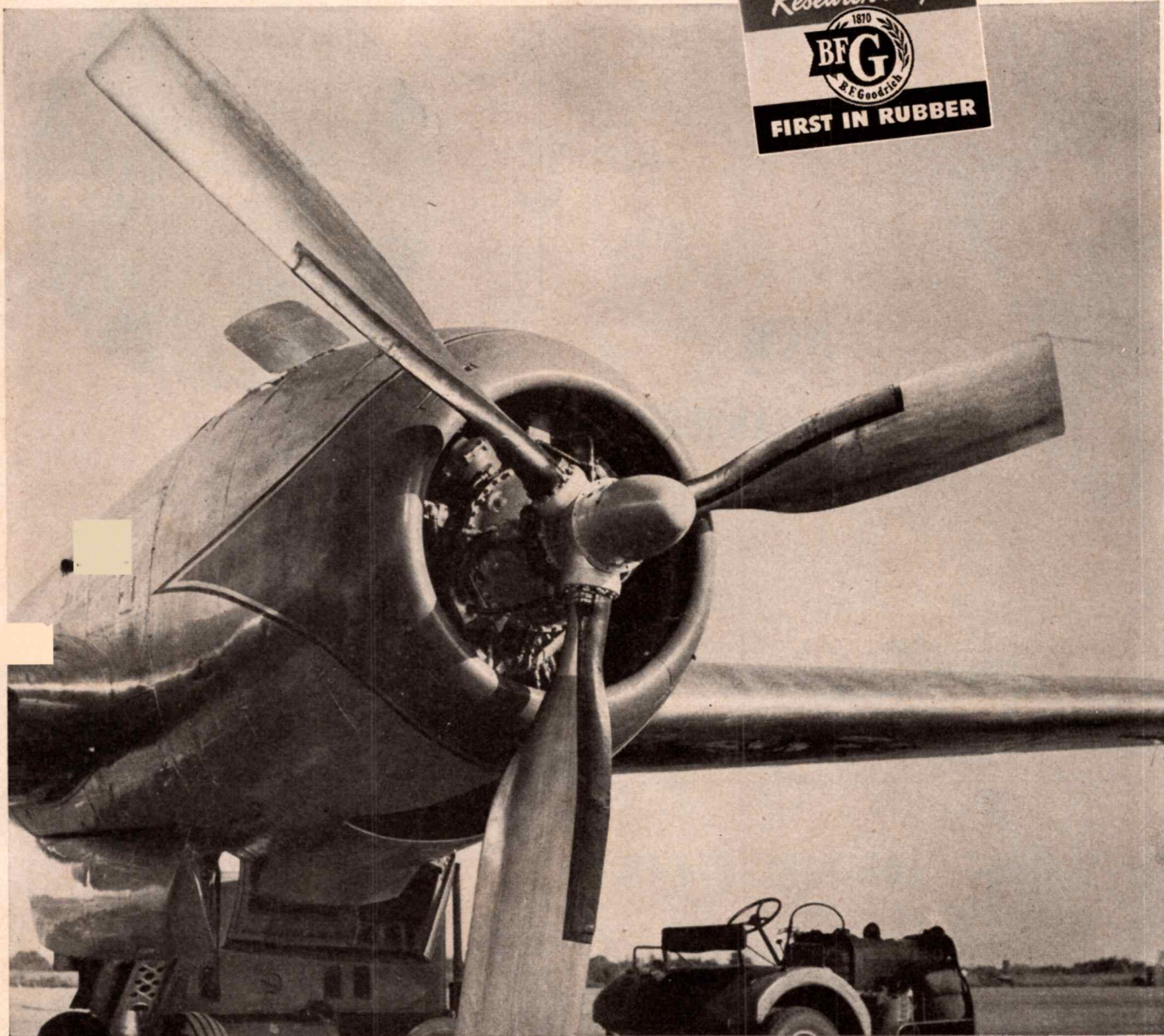
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11th Annual Directory of the Aviation Industry

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MARCH 1950

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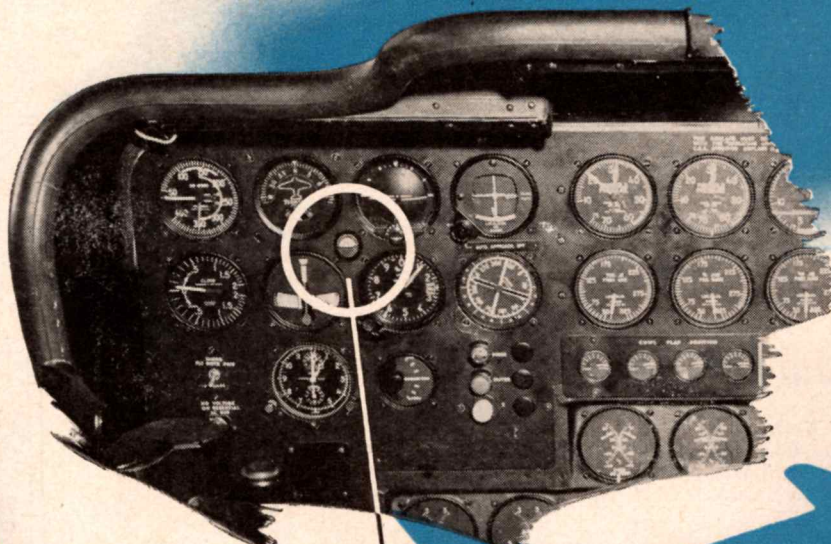


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EDITORIAL

Start in Washington!

NO ONE today knows what the next few months will bring to these United States but, be it war or peace, the continuity of the American way of living lies in the immediate elimination of the Communistic trend in Washington. Starting with the White House, the Supreme Court and the State Department down to the pages in the Senate and the House.

Specific prophecy as to what may happen, almost any time, can be forecast only by looking at the history of wars over the past centuries. The world has engaged in 3000-odd conflicts; that is, a war about every year. Today the world is teeming with unrest and revolution, most of it emanating from Communistic influences. Since 1932, the Russian Communists have had a helping hand from our White House occupants. Knowingly or unknowingly, the results have been of assistance to the Reds.

However, these force-compelling facts, unless considered and provided against, will descend on us with a tragic impact that will make the Pearl Harbor catastrophe look like a kindergarten lawn party.



The evidence is increasing daily that the Soviets have adopted the Hitler formula of infiltration. Recall Austria, Poland and Norway.

Now look back a few weeks at the Alger Hiss trial when a jury handed down a guilty verdict of perjury and Communistic spying. The conviction of Hiss may awaken the one hundred and fifty millions of Americans as to what has been going on during the Roosevelt and Truman administrations, backed by a "hand picked" Supreme Court and State Department. Hiss, top advisor to Roosevelt at Yalta and to Secretary Stettinius at the birth of the United Nations in San Francisco!

When Hiss was accused before the House Un-American Activities Committee, Aug. 5, 1948, Truman said the investigations were being used "as a red herring" to keep from doing what that Congress should have done. On Dec. 16, after Hiss had been indicted, he still "considered the investigation a red herring."

On January 27 of this year, Alger Hiss having been convicted by a Federal jury, the President was asked again whether he still felt that the Hiss-Chambers investigation had been merely a "red herring." On that occasion the President said he would answer no "red herring" questions.

Hiss, having an associate justice of the Supreme Court take the witness stand and swear to his reputation for "loyalty and integrity"!



In the present highly critical international situation, and with the aggressive expansion of the Soviet in the East, it is about time for Congress to stop fiddling around with their dreamy alphabetical programs and, as Al Smith would say, "take a look at the record." It might prove sufficiently revealing to initiate a few more Federal indictments, maybe a bit "higher up."

We are losing the Cold War under Truman's and Acheson's guidance and have made Russian and Asian Communism the dominant power outside the Western Hemisphere.

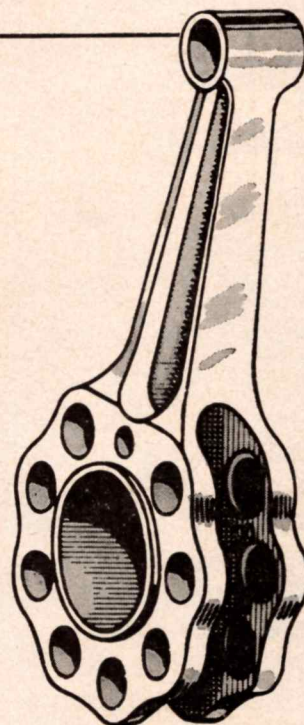
"The only possible war which confronts us is the next one."

The only possible enemy we have is Russia.

Only Air Defense can stop Russia.

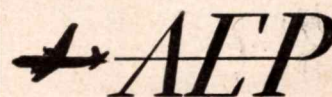
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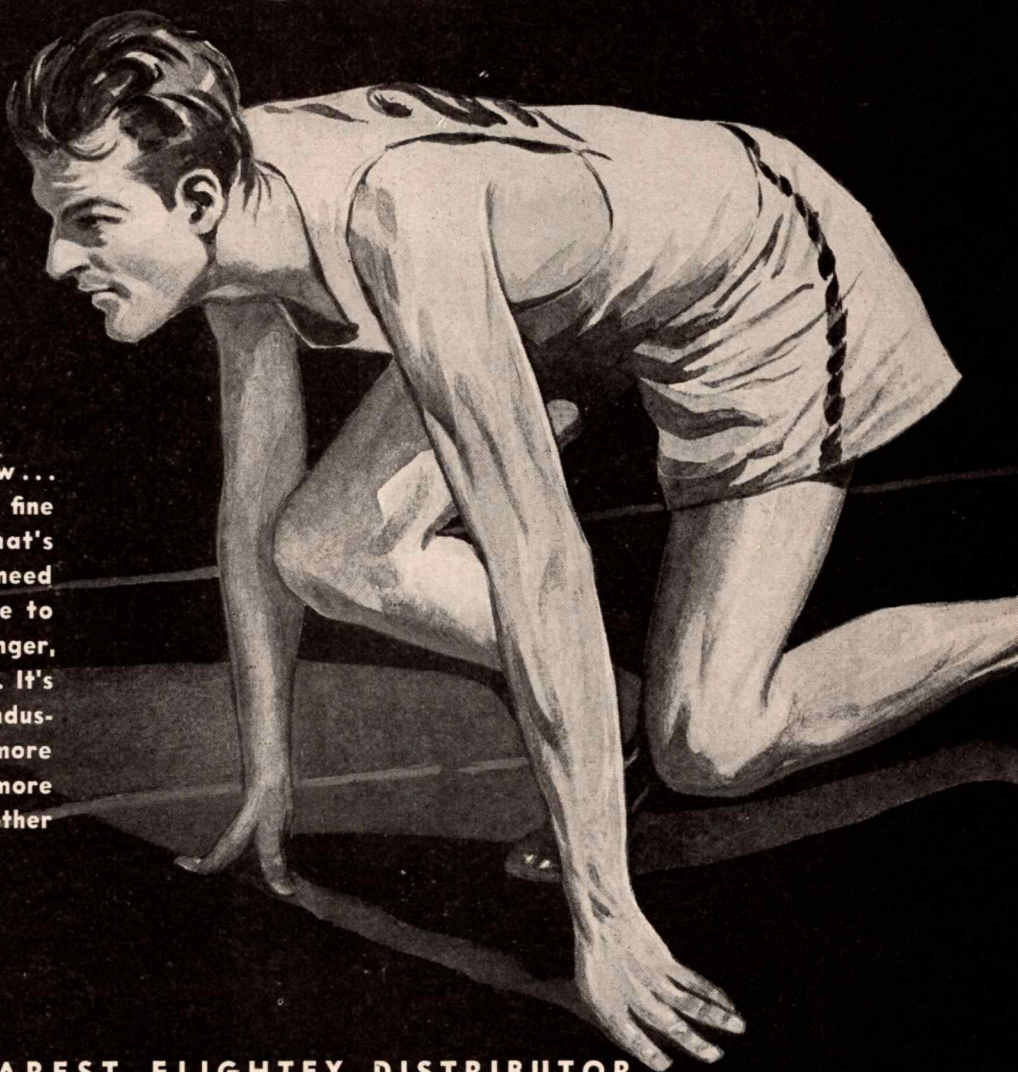
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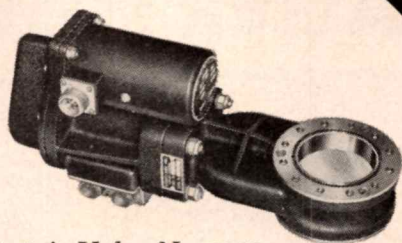
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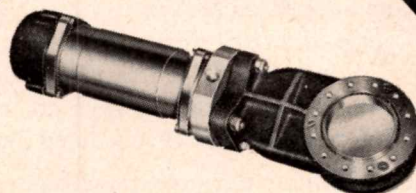
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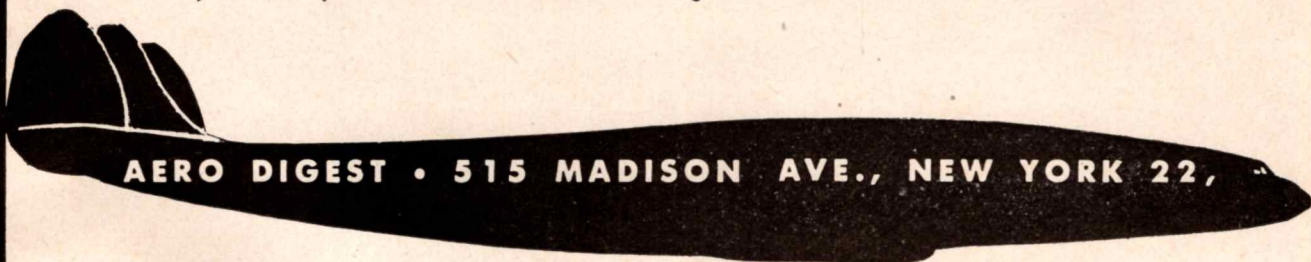
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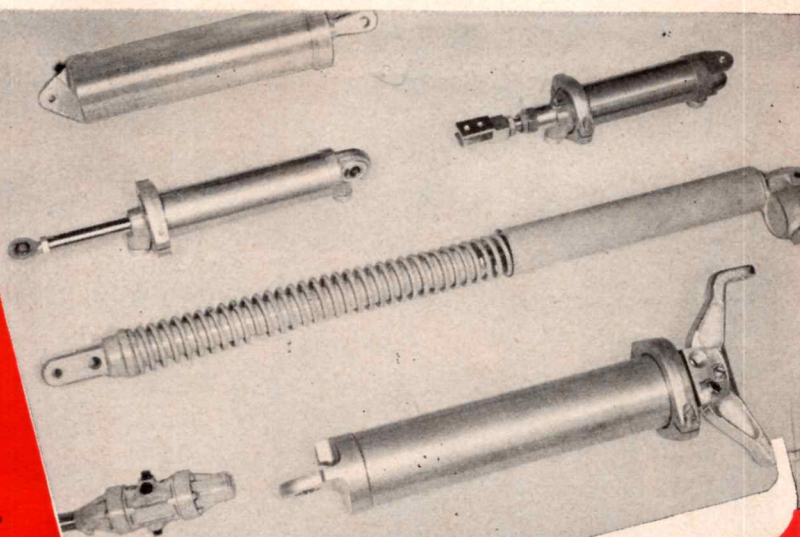
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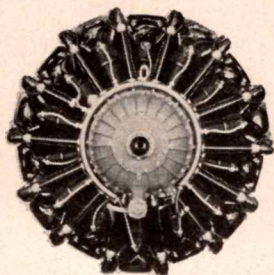


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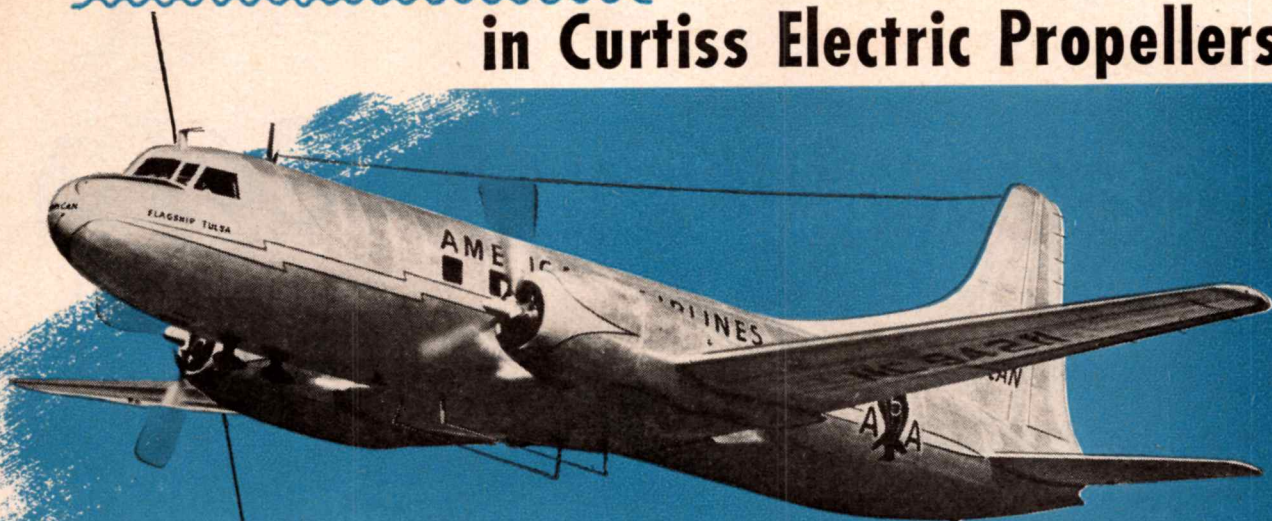
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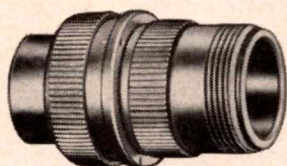
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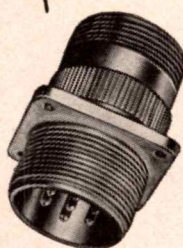
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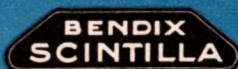
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Boeing B-47
Stratojet bomber



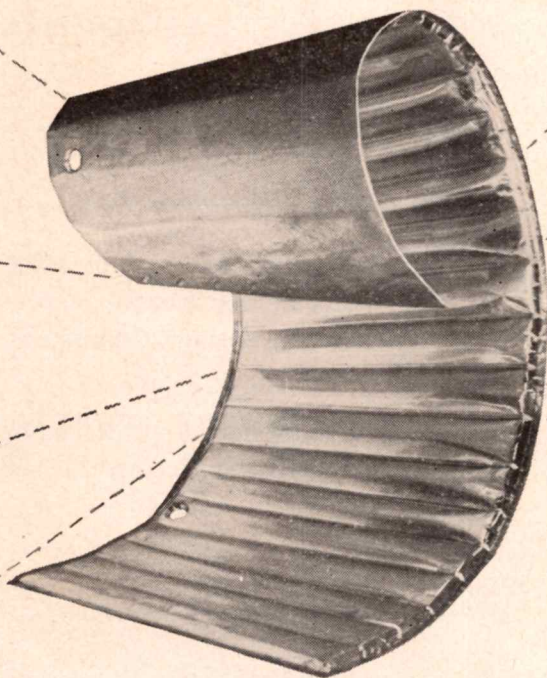
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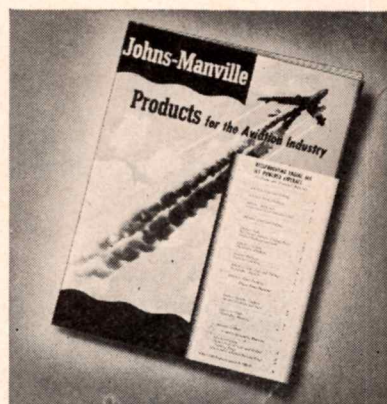
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These flexible blankets owe their insulating efficiency to a Thermoflex felt completely sealed within corrosion-resistant Inconel or stainless steel metal foils. At 800 F. mean temperature the conductivity of the felt (4 lb. per cu. ft. density) is only 0.76*. Yet the complete blanket weighs

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"Any such (mobilization) plan must be predicated on the maximum and long-range use, not of a few prime aircraft plants or of a handful of industries, but of thousands of factories and scores of industries." Plane above is Republic XR-12, a long-range photo-reconnaissance aircraft with a cruising speed of 400 mph and service ceiling over 45,000 ft

ROBERT C. DUFFIE

HOW can we purchase optimum air power for the minimum peacetime expenditure of the tax dollar? The answer to this vital question lies partially, at least, in the immediate implementation of a workable program of national industrial-resources evaluation.

An evaluation is required because effective mobilization planning and adequate air strength, two of the most important, technically complex and interacting facets of our defense problem, are suffering from a critical malady whose primary symptoms are limited contract distribution and high cost.

If only the intricacies and expense of designing, developing and producing efficient aircraft under ideal production conditions—a situation rarely prevailing in the aircraft industry—were involved, the military, political and budgetary difficulties would be formidable. However, an infinite number of other industrial, economic and financial factors are tied in with the job of total air-industrial mobilization.

Some of the more significant are:

- (1) The public must be convinced that the adoption of such planning is not committing us to war;

- (2) Planning must be done in advance of open conflict;
- (3) The price of the entire program of defense contemplated has to be gauged to the willingness and ability of the public to pay both in taxes and through the surrender of business prerogatives in the national interest;
- (4) Any such plan must be predicated on the maximum, economical and long-range use, not of a few prime aircraft plants or of a handful of industries, but of thousands of factories and scores of industries;
- (5) All the above must be done without disrupting, dislocating, discouraging or retarding non-military production during peacetime. Furthermore, it must be done from a foundation of superior knowledge of potential enemy capacity and capability, and maximum Government-industry co-operation.

The chief deterrent to this type of production planning remains a general public misunderstanding of its importance, purpose and nature. This public opinion void is largely the responsibility of national defense leaders who have failed to convey to the American people the increasingly extensive involvement of their Government in the myriad of industrial mat-

ters that a \$15.5 billion military budget makes unavoidable. The key to U. S. industrial invincibility meanwhile is not (and by its nature never can be) secure from an enemy who applies himself to its systematic acquisition, for there is nothing basically mysterious or secret about it.

Yet, the Defense Department's new-type "security" red tape, over which the American small business man now fumbles, is strewn out in the vain hope that it will thwart a resourceful and energetic opponent. Simultaneously, the same Department (if the opposing stand of the Services during the B-36 inquiry is taken into account) is neglecting to acquire much more important (to us) data on the industrial plant, transportation network, aircraft types and other related matters, concerning our chief potential opponent.

The exact measure of this inadequacy is, of course, unknown outside of the Pentagon, but its extent can be judged from the fact that high-ranking patriots cannot be believed to hold divergent views while the precise nature of enemy preparations are known.

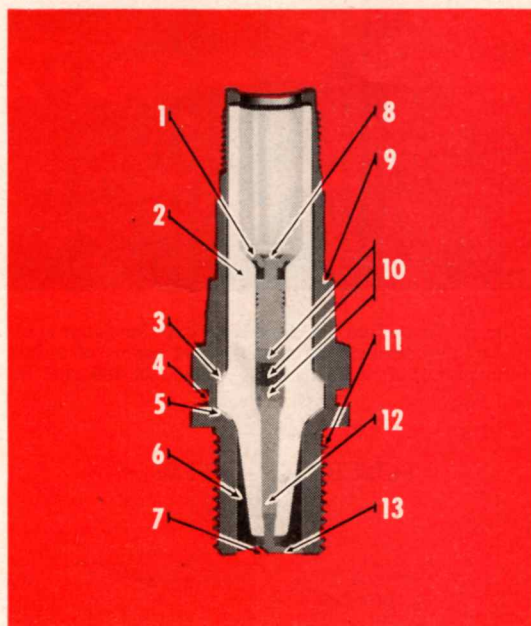
Since publicity on industrial planning must sometimes be restricted because of legitimate security reasons,

(Continued on page 135)

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- 9 Brazed one-piece construction with zinc-plated finish
- 10 Gastight Hermetic seal
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 - Glass-graphite resistor seal, halving electrode wear.
 - Copper-glass conducting seal.
- 11 18 MM threads, precision-rolled to mirror finish
- 12 Silver, centrifugally cast to insure good heat conducting contact with insulator
- 13 One of two large .040" square platinum ground electrodes

The AC-181 Aircraft Spark Plug is amazingly trouble-free—astonishingly long-lived. After a continuous world flight of 23,452 miles in the B-50, "Lucky Lady II" the AC-181's were in excellent condition, despite their 94-hour beating in the stratosphere.

The AC-181 stands out because it stands up. It resists lead fouling better—requires fewer off-schedule

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No other aircraft plug can offer you the same combination of extra-quality features. Approved by Pratt and Whitney and CAA for five P&W engines. Look at the sectional drawing and you'll see why.



AC Plugs for jet engines have also participated in the establishment of many speed records.



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SURVIVAL

in the 3rd World War

CY CALDWELL

TWO recent events should have given the people of the U. S. and the British Empire fair warning that the era throughout which they have held joint command of the seas may be nearing its end. Those events are the utilization of atomic energy by the Soviets, and the incorporation of China into the Communist group of nations.

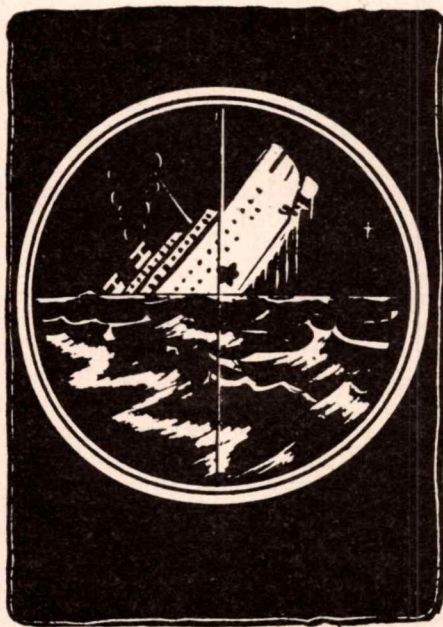
The connecting links between these events are mechanical: the greatly improved submarine and the long-range rocket. To military men, this is not hard to explain; but the average citizens deficient knowledge of strategic geography makes the task of explanation no simple process. Add to that his almost complete unawareness that the U. S. and Britain are islands of industrial dependence on the rest of the world. Their survival in war or even in peace has depended solely on shipping, guarded by two strong navies.

So far as supplies of tin, chromium, tungsten, vanadium, manganese, quartz and other basic material are concerned, we are a pauper nation. And we must import chiefly by sea.

When we speak of an inter-continental bomber we are indeed—though often unknowingly or unthinkingly—describing it accurately. For the materials from which it has been constructed, and from which the tools to construct it have been made, have come from every continent on the globe.

Our industrial civilization cannot long continue without free access to the rest of the world for basic critical materials—to say nothing of world markets for our manufactured products and our agriculture.

Sea power, like air power, is a land-based force. The British and the U. S. navies achieved control of the seas largely by having available operating bases in every part of the globe. In two world wars past, the Japanese Navy could operate only in the Pa-



cific; the German Navy—largely and most effectively sub-surface—could operate only in the Atlantic.

In the next war, the Russian submarine navy will be able to operate in both oceans, right from the war's start. It already has the bases—from Siberia, a few miles from Alaska, south to Vladivostock. It long has been operating submarine bases at Port Arthur and Dairen, China, which were given to Russia with Anglo-American blessings at Yalta. With a Communist regime now controlling China, is there any lingering doubt that Russia would be given operating bases along the entire China coast, south to Hainan and French Indo-China—which may not be French very long?

From bases strung along the entire east coast of Asia, Russian submarines not only could attack our supply lines near their source but also attack shipping approaching our west coast. That the Japanese failed to do this should give us no cause for complacency, or any assurance that the Russians can-

not or will not do so. Japanese submarines were used improperly, mostly kept tied to surface naval forces, and their powers only partially exploited. The Russians may have learned from Japanese errors, and also from American successes with submarines.

In Europe, Russia already has every harbor from the Gulf of Finland through the Baltic to Germany; also the Russian Arctic Ocean coast, which has two very good ports, Archangel and Murmansk. It is doubtful if the Russian submarine navy even needs the help of the Red Army to capture Holland, Belgium and Northern France in order to gain the further advantage of submarine bases on the Atlantic. Modern submarines should be able to operate efficiently in the Atlantic from bases now in Russia's hands.

The modern Schnorkel submarine is a truly powerful and elusive weapon of sea warfare. With its air-breathing Schnorkel tubes it may remain submerged for the duration of its cruise, and it has a range sufficient to operate along our entire east coast and into the Gulf of Mexico. With the help of submarine tankers to refuel the raiding submarines, they could remain off our coasts for many months, without returning to their bases.

The Red Pacific

The Chief of Naval Operations, recently in Japan, told the press that the Russians had 80 submarines in commission in the Pacific. They are reported to have some 300 now in commission, are said to be building a fleet of 1000. That seems a reasonable guess: submarines are small ships, around 1300 to 1500 tons, about 300 ft long.

Parts could be manufactured anywhere in the interior of a nation, shipped to the coast and assembled. Of light draught, they could operate from a hundred bases. Even in the old-style war of submarines firing tor-

pedoes at merchant ships, their individual chances of success are perhaps 100% greater than they were in World War II. They can remain submerged for long periods and have about doubled their under-water speed by a streamlining and using the diesels rather than their batteries—which are used only when they are below Schnorkel depth. It would seem a reasonable surmise that, considering the improvements in submarines in the hands of the enemy, they are from two to 10 times the menace to shipping that German and Japanese submarines were in the past war. Much depends upon the number built and the efficiency of the crews trained to operate them.

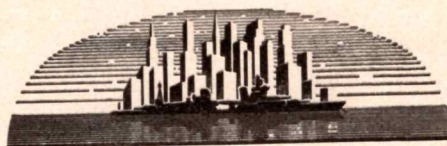
However, a torpedo is a limited weapon of short range. It runs under water at only 45 knots, carries a warhead filled with an obsolescent explosive and is effective only against the hulls of ships, which have repeatedly dodged by zig-zagging. It would seem that such a greatly improved vessel as the new submarine deserves a more modern and more destructive weapon—the long-range guided missile, a radio-controlled rocket carrying a warhead filled with fissionable material: in short, an atomic rocket.

There's No Limit

If this seems a somewhat imaginative conception, remember that the atomic bomb has become a household word; that the guided missile, carrying a ton of explosives, was used with some success in the past war, and that combining the rocket and the atomic explosive should not prove an insurmountable problem. In fact, it is a foregone conclusion that both Russia and the U. S. already have such a weapon in existence. If they haven't, then their engineers are indeed slow to take a hint from the scientists.

Rockets have been launched from naval vessels, and pictures of the act have been published. No pictures of one going up from a submarine have been shown; nor has that matter been discussed in public. The reporter's bottleneck here, of course, is that everything is on the top-secret list. "Secret," "confidential" and "restricted" are words that have been used in the past—and no doubt are being used today—to cover up instances of incompetence, ignorance and general stupidity, under the excuse that we are keeping vital information from the enemy.

Let's suppose that our guiding naval brains and those of the Russian brass are reasonably intelligent. In that event, *both navies must already have the guided atomic missile, and have means for launching it from a submarine.*



Here, perhaps, a technical guess is in order. We are accustomed to think of torpedoes as being carried within the pressure hull of a submarine. Since a rocket is a very large weapon, it would be most natural to carry it outside of the pressure hull, on launching ways, an integral part of the ship's streamlining. In the German and Japanese one- and two-man submarines of the past war, one or two torpedoes were carried thus, outside of the pressure hull and streamlined into the hull. It would seem to be a comparatively simple engineering problem to mount atomic rockets on the deck, forward or aft of the conning tower or bridge in present submarine types. Newer types, especially designed as rocket subs, might have the bridge aft, or forward of present position.

If we accept the above as a reasonable proposition, then it becomes clear why our Navy has not yet made the fact public. As against Russia, we are at a tremendous disadvantage. With this weapon, they can do us grievous damage; without it, the best we can accomplish is atomic bombardment of their submarine bases. We cannot hit one of their important cities; they can bombard every city along all of our coasts.

It is tempting at this point to picture a submarine rocket attack on our coastal cities, but for intelligent readers that is unnecessary. Simply recall Hiroshima, and multiply it by a hundred. Or would you say 200? It is reasonable to assume that every available Russian submarine would be in position, anywhere from 20 to 200 miles off U. S. coasts. At zero hour of the Atlantic, Pacific, and Gulf Coasts—and off the Panama canal in both oceans—the submarines would surface and launch their rockets.

One might long speculate about the number of direct hits that a hundred or more atomic rockets might register, and the number that would go astray of the target and land in the fields beyond or in the sea. But we should accept the reasonable belief that, unless the rockets have a fair degree of accuracy, they will prove too uncertain for dependable use. Lack of accuracy in guidance might hold up the

moment of their first employment in war. But considering human ingenuity in all fields—except in the art of getting along peacefully with each other—I have no doubt that this detail of rocket guidance will be perfected.

The primary purpose of a submarine is to attack and sink surface ships, naval or merchant. As the Russians have only a small merchant marine and a negligible surface navy, our submarines would have no worthwhile surface targets. The Soviets, on the other hand, would have the great merchant marine of the U. S. and the British Empire and their allies as conventional submarine targets, to be attacked with standard torpedoes. In addition, they would have a powerful weapon to use against our anti-submarine forces—carriers, destroyers, and other vessels in the hunter-killer groups. Their further advantage—atomic attack on our coastal cities—is denied us, for Russian centers of importance are in the interior and may be attacked only by the Air Force, as may the submarine bases.

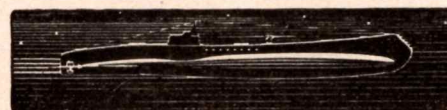
Our use of the submarine is perforce limited to these tasks: attack on Russian surface vessels, on all submarine bases, by rocket; training of our Navy and Air Force in anti-submarine warfare; use as radar and sonic listening pickets off the Russian coasts to give first warning of outgoing Russian bombers or submarines; use as transports for commando raiders and sent ashore to destroy submarine installations and to escape again by submarine; to pick up downed airmen at sea, as American submarines did with great success in the past war; and, finally, to seek out and destroy enemy submarines.

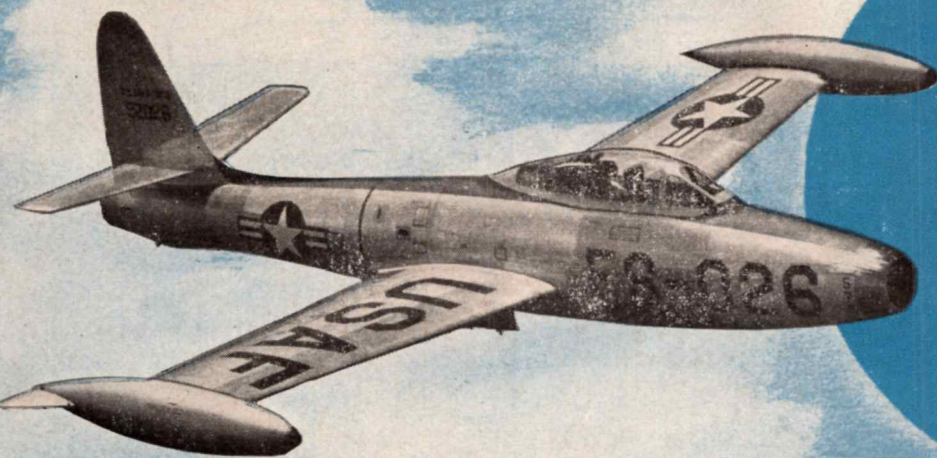
Our Hush-Hush Sub

The last is a new form of warfare on which our Navy is working—submarine fighting submarine—a very hush-hush project about which we probably will be given no information until after the war starts, if then. However, one point is obvious. Submariners are trained to live by acting upon information supplied to them by intricate electronic equipment. Better than anyone, they know how to use their ears and their minds below the surface of the sea and to distinguish between enemy and friendly submarines.

This correspondent has the feeling, amounting to conviction, that our highly intelligent undersea navy will open up an entirely new form of warfare, with good chances of success. In the Pacific, American submarines sank one or more Japanese submarines, though it seems that the enemy craft

(Continued on page 131)

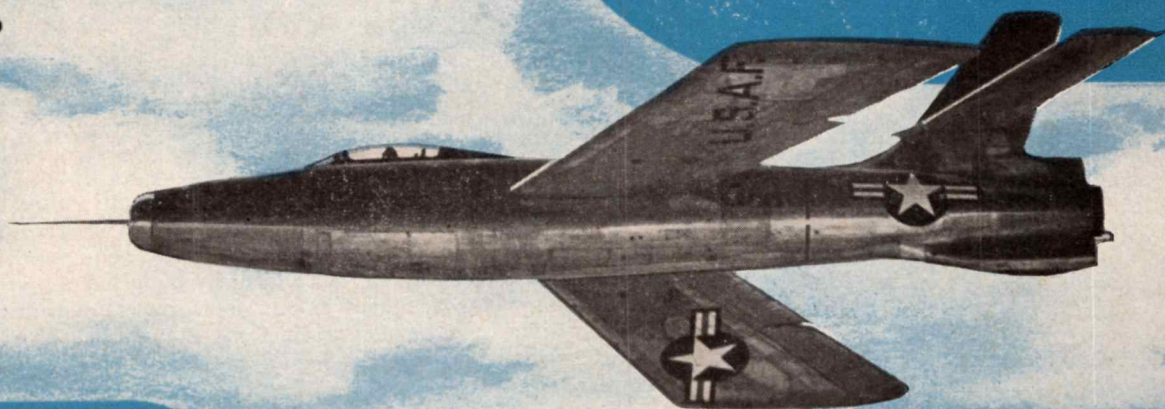




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KENDALL K. HOYT
Washington Editor



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THE recurrent question of whether or not air power is going to be increased this year has not quite been tackled. But officials are talking about the adequacy of our defenses, while resentment flares in Congress belatedly against last year's executive cuts.

How big? And who decides? That there is at least some debate on these two points, after months of seeming indifference, gives hope if not assurance. Otherwise, the large items of unfinished business (see December report) remain for the most part untouched. Prototype legislation, most important of the pending measures, is sadly fouled again.

First the issue of over-all defense. The people who listen to Defense Secretary Johnson will feel happily reassured; those who hear Air Secretary Symington may be worried. Johnson has stressed that we can rush to the attack in a matter of hours, which of course we can. Symington, however, thinks we can be attacked.

The Reds, he warns, have an air force already the largest in the world and still growing, a ground force bigger than those of the U. S. and allies combined, and also the largest submarine force. Soviet subs, we now know, are cruising in the Pacific by the dozens. Behind the iron curtain, there has been an atomic explosion and the Reds have planes that could strike at any prime target here. We have no sure defense, Symington declared.

Last year, the Air Secretary gave an air show for Congress and Government officials; he is seen again as making his bid for a bigger Air Force-in-being.

If Congress ups the budget once more, the defense chiefs will be allowed less discretion to cut it back.

Recently, after the House voted a 58-group program last year and the Senate acquiesced, the holding to the budgeted 48 groups was attacked by some Congressmen as "military dictatorship."

When Defense Secretary Johnson appeared before the House Appropriations Committee in January, he was given an unpleasant time. Though he was instructed by law to recommend cuts in the 1950 budget without endangering security, he was supposed also to give an explanation. Congress was informed as to the hundreds of millions saved; the details remain classified.

The peppery Carl Vinson, House Armed Service Chairman, is said to hold similar ideas, to be stated in his report on the investigations of Services' views held as an aftermath to the B-36 probe last session. So the two House Committees are pulling a cross-cut saw between them.

Possible outcome may be for the appropriations act to specify 58 groups and leave no discretionary power to cut below that figure.

Not in the Headlines

The public, however, is little aware of this debate which seldom appears on the front pages. Those who skip from there to the sports and funnies in their newspapers are not informed. No major effort is seen to get the word around.

In Congress, some of the best friends of air power are frank to say they don't know how much the Air Forces need. Having gone for the 70-group program, they felt let down when officials and industry people abruptly dropped the idea. It will not be easy to resell them. Nor will it be impossible—if really tried.

(Continued on page 132)

precision counts in this air giant

The Boeing Stratocruiser is setting new records in global transportation, making yesterday's "far away places" today's "next-door neighbors."

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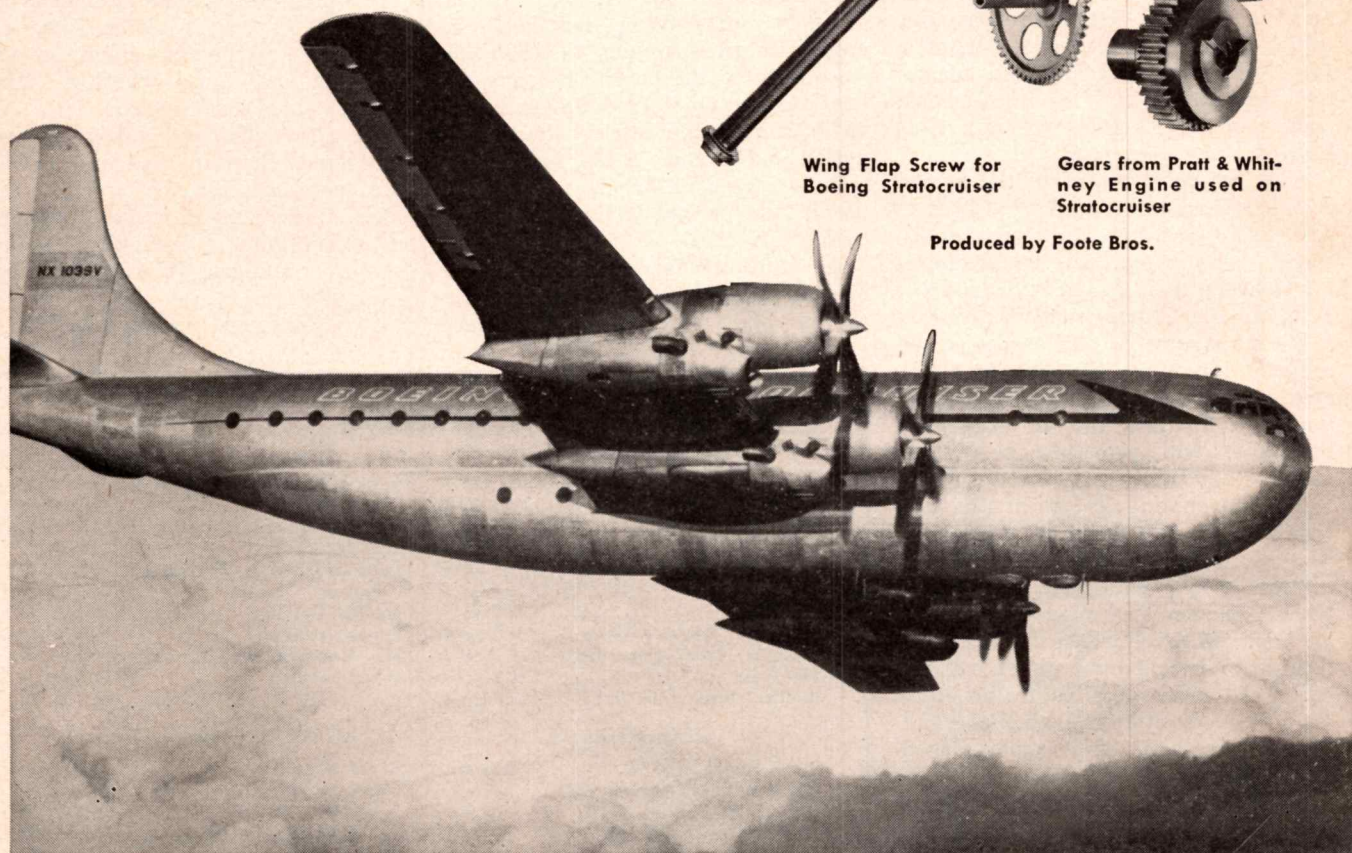
Better Power Transmission Through Better Gears



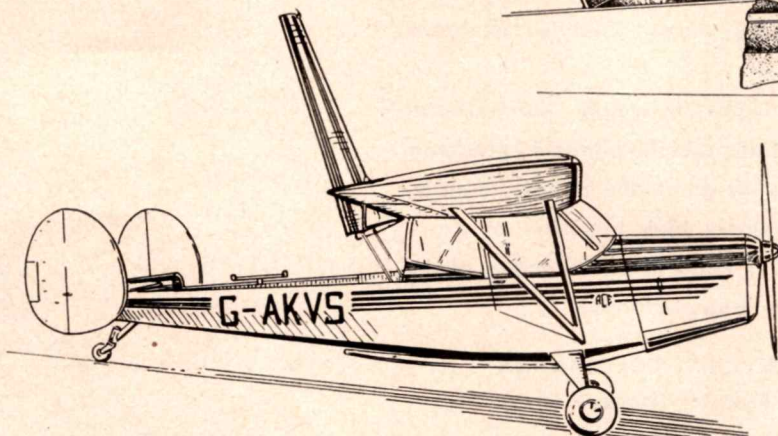
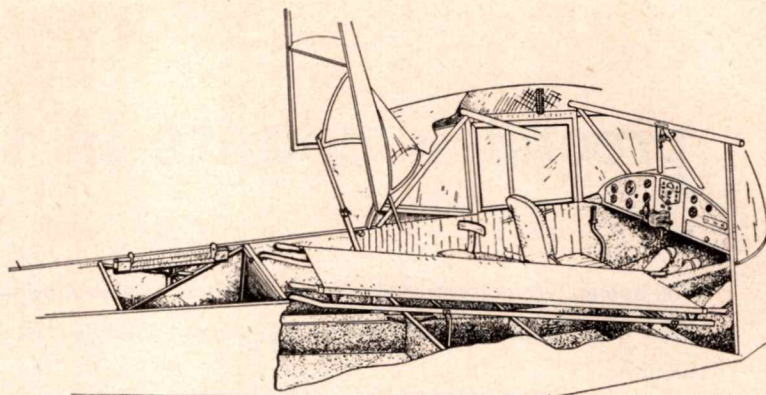
Wing Flap Screw for
Boeing Stratocruiser

Gears from Pratt & Whitney
Engine used on
Stratocruiser

Produced by Foote Bros.



The Chrislea "Skyjeep" features built-in versatility. It carries full flight equipment for back-country operations and is convertible in a matter of minutes from passenger to cargo or ambulance transport. Seats four, ordinarily; has a large baggage compartment, and the rear fuselage deck hinges upward to permit stowage of long articles. Cabin features 360° visibility



CHRISLEA "SKYJEEP"

GREAT BRITAIN'S aviation industry has been increasingly attentive, during the past several years, to the potentialities of her export markets. A recent positive indication of this attention was the initial flight, this past November, of a new lightplane, designed and manufactured specifically for the export trade by the Chrislea Aircraft Co., Ltd. of Exeter, England.

A direct development of the Series 2 *Super Ace*, introduced by Chrislea just two years ago, this new craft, called the *Skyjeep*, will be available for delivery this spring. Powered by a 105-hp Blackburn *Cirrus Major III*, it has a range of 530 mi at a sea-level cruising speed of 110 mph at 2200 rpm, and a maximum speed of 130 mph. At the new rate of exchange, the price will probably be £2250 (about \$6300), fly-away-factory.

The outstanding feature of this new lightplane is its built-in versatility. The manufacturer, realizing that the aircraft would be operated in areas where terrain is rugged, airports are few and maintenance facilities are lacking, redesigned the aircraft to incorporate every possible feature that would aid operators in both flying and overhauling the ship under such conditions.

Some of these features include Frise-type ailerons, enlarged cabin and baggage compartment, crash-proof wing tanks, instrument flying equip-

ment, hinged rear fuselage deck aft of cabin, complete electrical equipment, hydraulic brakes and undercarriage designed to accommodate crosswind landing gear.

Another outstanding item is the increase in gross weight to 2500 lbs. According to the cargo-version specifications, the empty weight—including radio, starter, generator, battery navigation and landing lights, instruments and wiring—is 1485 lbs, allowing a useful load of 960 lbs and a payload of 700 lbs.

A familiar characteristic of the *Skyjeep* is the full-view cabin, permitting 360° vision and the hinged

metal rear-fuselage deck, allowing the stowage of bulk cargo up to 14 ft in length, or a standard military stretcher. It is claimed that the ship can be converted from passenger to cargo transport in seven minutes and from passenger to hospital transport in 15 minutes. In the passenger version, it is a 4-place aircraft; but two additional seats for children up to 50 lbs can be installed in the luggage compartment, which has a volume of 75 cu ft.

The tricycle landing gear of the *Super Ace* has been replaced by conventional fixed-tailwheel gear with provisions for the installation of crosswind main gear. Apart from this change and the installation of wing tanks, the fuselage-and-wing configuration of the *Skyjeep* is much like that of its predecessor. The fuselage is constructed of welded-steel tubing, with wooden stringers, aluminum-alloy coaming and fabric covering. Wings are of welded steel-tube spar truss, with light alloy ribs and fabric covered. Tailplane, elevator, fins and rudders are metal covered, as are the wing flaps. The exhaust-muffled engine is equipped with a fixed-pitch wooden propeller and has an overhaul life of over 600 hrs.

(Continued on page 127)

Specifications

DIMENSIONS			
Span	36 ft	Rate of Climb (initial) at S. L.	600 fpm
Length	21 ft 6 in	Rate of Climb (initial) at S. L.	1300 fpm
Height	7 ft 3 in	Takeoff Distance (5-mph wind)	
Track	6 ft 3 in	at S. L.	150 yds
Gross Wing Area	177 sq ft	Landing Distance, (5-mph wind)	
Aileron Area	13.6 sq ft	Braked	130 yds
Flap Area	20 sq ft	Service Ceiling	14,000 ft
Tailplane Elevator Area	24.5 sq ft	Range (still air)	530 mi
Elevator Area, (inc. tab)	9.7 sq ft	Fuel Consumption (cruising)	8 Imp gal
Fin Area	9.2 sq ft	Wing Loading	14.1 lb/sq ft
Rudder Area (inc. tab)	5.9 sq ft	Power Loading on 155 bhp	16.1 lb/hp
PERFORMANCE		WEIGHTS (Passenger Version)	
Max. Speed at S. L.	130 mph	Gross Weight	2500 lbs
Cruising Speed—Econ. (2200 rpm) at S. L.	110 mph	Empty Weight	1540 lbs
Stalling Speed—(flaps down) at S. L.	48 mph	Fuel (39 Imp gal)	280 lbs
		Oil (3¾ Imp gal)	34 lbs
		Pilot and Payload	646 lbs

VICKERS

CONSTANT DISPLACEMENT

PISTON TYPE PUMPS

have many
advantages

HIGH
EFFICIENCY

LOW
WEIGHT

LONG LIFE

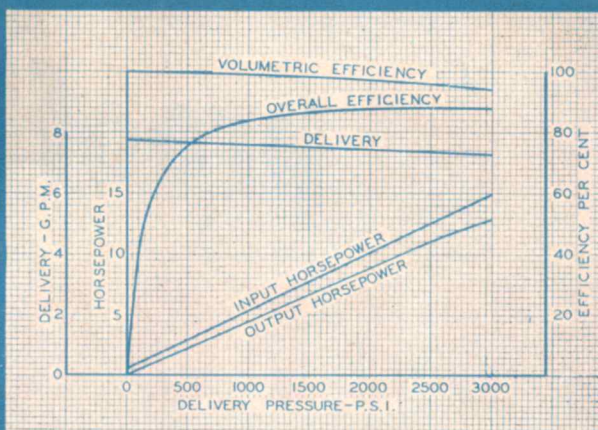
SIZES TO
40 hp

PRESSURES
to 3000 psi

Listed at the left are the important reasons why Vickers Constant Displacement Piston Type Pumps are so widely preferred for modern aircraft hydraulic circuits.

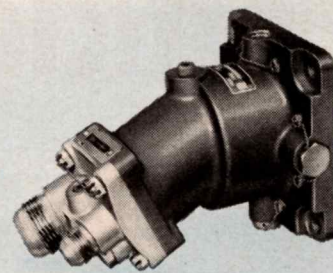
Note particularly the typical performance curves that prove the very high volumetric and over-all efficiency of these pumps. Extremely high horsepower to weight ratio is also important . . . 1.96 hp per lb for the Model PF-3911 Pump operating at 3000 psi and 3750 rpm. Dependability is another feature . . . airline life in excess of 10,000 hours has been reported. Each of the six basic model series shown here is available in four sizes (angles) for continuous duty at pressures to 3000 psi.

Ask for new Bulletin 49-53 describing "The Most Complete Line of Hydraulic Equipment for Aircraft."

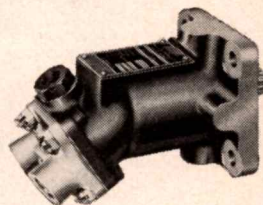


Curves are for Vickers Aircraft Piston Type Constant Displacement Pumps Model PF-3911 Series at 3600 rpm using approved AN aircraft type hydraulic fluid.

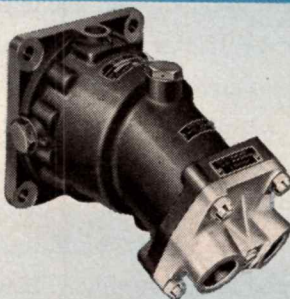
Vickers Model
PF-3911 Series
for 3000 psi



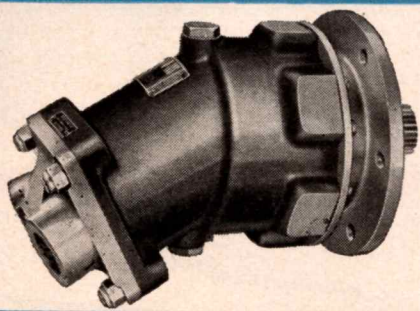
Vickers Model
PF-3906 Series
for 3000 psi



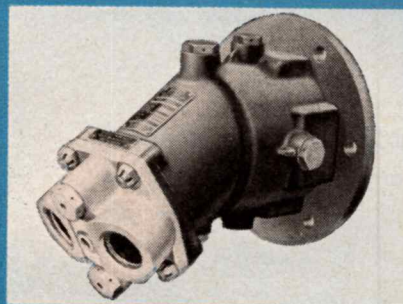
Vickers Model
PF-3913 Series
for 3000 psi



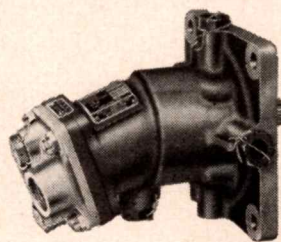
Vickers Model PF-3918 Series
for 3000 psi



Vickers Model PF-3915 Series
for 3000 psi



Vickers Model PF-3909 Series
for 3000 psi



VICKERS Incorporated

DIVISION OF THE SPERRY CORPORATION

1458 OAKMAN BLVD. • DETROIT 32, MICHIGAN

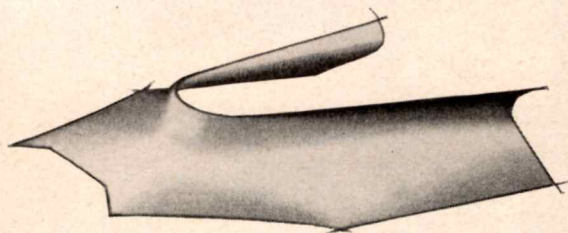
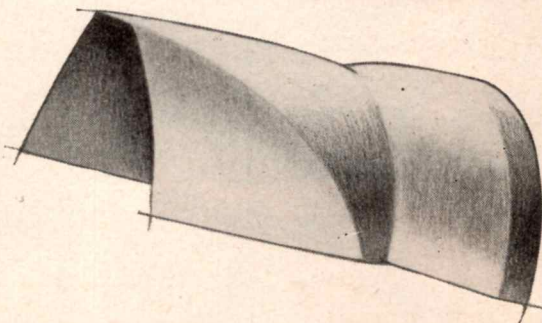
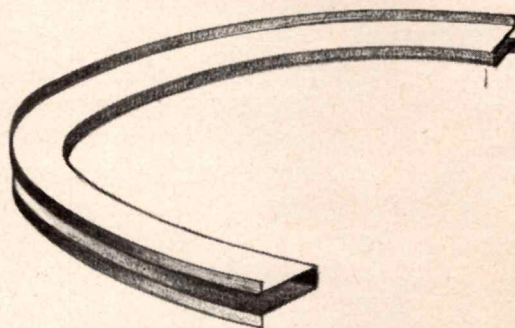
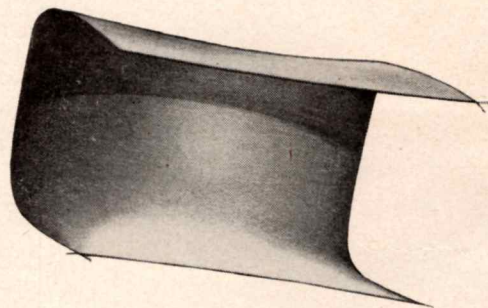
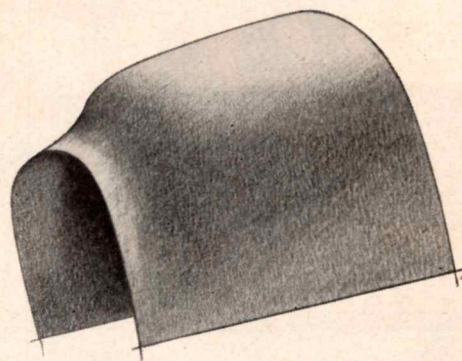
Engineers and Builders of Oil
Hydraulic Equipment Since 1921

Want proof* of HUFFORD efficiency?

* These five typical aircraft parts tell a story of Hufford savings. Each was formerly made on equipment commonly found in large plants. With the installation of a Hufford stretch-wrap forming press, parts were switched to the new machine in an effort to improve production and efficiency. The results speak for themselves.

Besides speed, accuracy and economy, numerous other advantages result with the Hufford system. Parts may be formed directly in the ST condition, eliminating heat treatment and refrigeration. Straightening, planishing, drop hammer operations and other corrective procedures are usually unnecessary. Material is uniformly stressed over-all. Yield strength is actually increased, and often ultimate strength is improved. Uniformity of pieces effects savings in hand labor and assembly time. *These are typical of the many ways Hufford stretch-wrap forming makes better airplane parts at lower cost.*

Whatever your forming problem, whether it involves extrusions or skins, investigate Hufford—the only machine with the exclusive stretch-wrap forming principle.



The machine illustrated is the Hufford model 46 stretch-wrap forming a large sheet.

INTER DUCT NACELLE SKIN

Formerly made of 24 SQ, now formed two at a time of 24 ST on a Hufford. Excessive breakage, heat treatment, refrigeration and straightening of parts experienced with original forming method now completely eliminated.

INTER SCOOP DUCT SKIN

Hufford process reduced breakage from 35% to 1% besides eliminating crown roll.

FUSELAGE FRAME

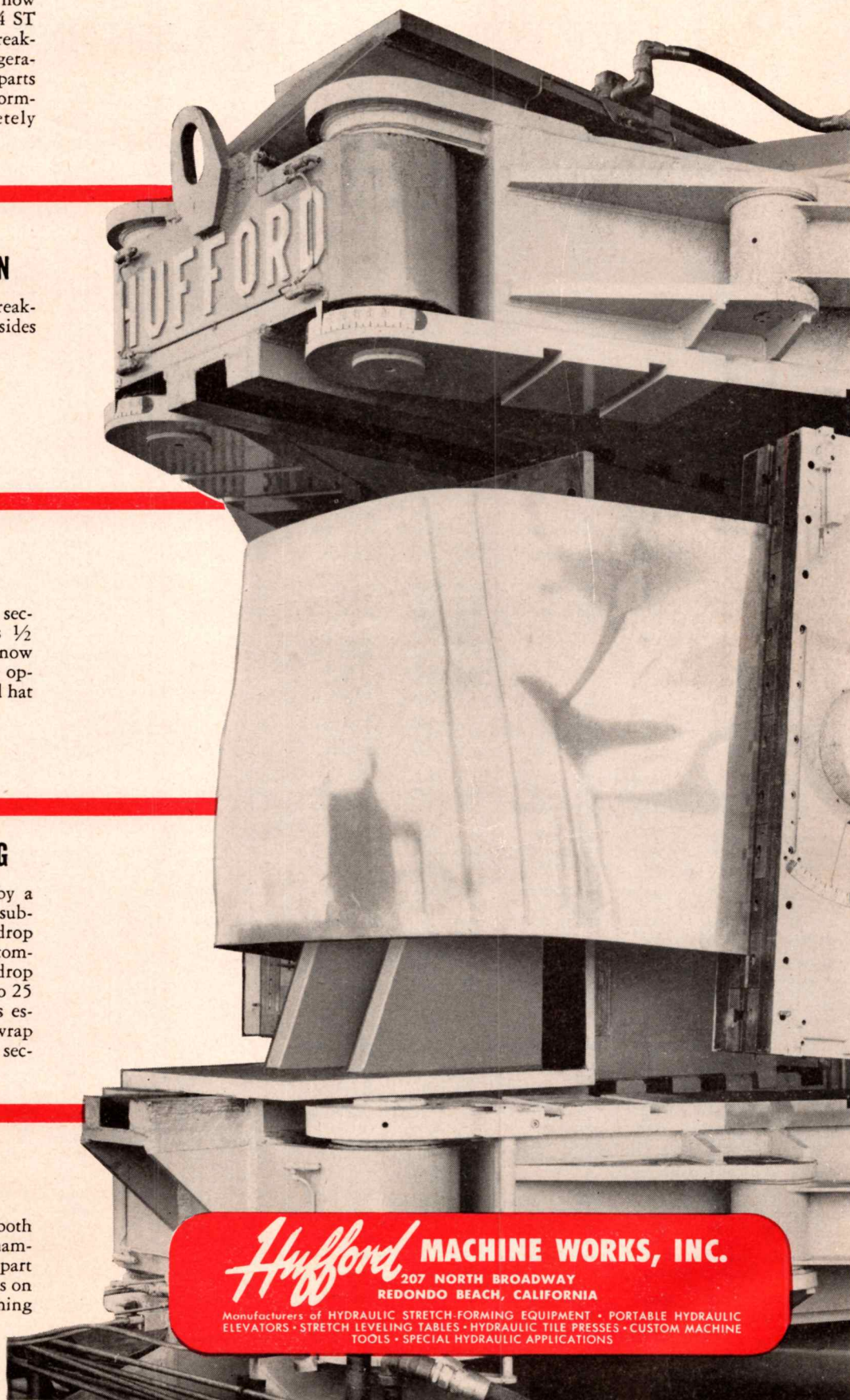
Formerly made of two "Z" sections welded together, this $\frac{1}{2}$ hard stainless steel frame is now stretch-wrap formed in one operation from a brake formed hat section.

TAIL PIPE SHELL FAIRING

20 minutes starting time by a stretching process plus two subsequent operations on a drop hammer were required to complete this part. The two drop hammer dies were limited to 25 parts before reworking was essential. Part is now stretch-wrap formed on a Hufford in 45 seconds complete.

PILOT'S CANOPY FILLET

One hour's time employing both drop hammer and power hammer for completion of this part was reduced to three minutes on a Hufford stretch-wrap forming machine.



Hufford MACHINE WORKS, INC.
207 NORTH BROADWAY
REDONDO BEACH, CALIFORNIA

Manufacturers of HYDRAULIC STRETCH-FORMING EQUIPMENT • PORTABLE HYDRAULIC ELEVATORS • STRETCH LEVELING TABLES • HYDRAULIC TILE PRESSES • CUSTOM MACHINE TOOLS • SPECIAL HYDRAULIC APPLICATIONS

LAMPS FOR AIRCRAFT LIGHTING

The lamps listed are those recommended by the Illuminating Engineers Society and the Society of Automotive Engineers, according to the service indicated. This list is not a catalog; does not include many types now in use.

Line No.	Service	Circuit Volts	Lamp No.	Army-Navy Part No.	Amps. Watts Candles	Bulb	Base	Filament	Light Center Length (Inches)	Max. Over-all Length (Inches)	Design Volts	Max. Amps. at Design Volts	Rated Avg. Life (Hours) ⁽⁴⁾	Approx. Weight Each (Pounds)	Line No.
1	Landing	6	4538		100W	PAR-46	So.Term.	C-6		3-3/8	5.4		25	.92	1
2	Landing	12-16	4537		100W	PAR-46	So.Term.	C-6		3-3/8	13.0		25	.92	2
3	Landing	12-16	4522		250W	PAR-46	So.Term.	C-2V		3-3/8	13.0		25	.92	3
4	Landing	24-28	4523	AN3129-4523	250W	PAR-46	So.Term.	C-13		3-3/8	28.0		25	.92	4
5	Landing	24-28	4560	AN3130-4560	600W	PAR-64	So.Term.	C-13		4	28.0		25	2.00	5
6	Taxiing	24-28	4570		150W	PAR-46	So.Term.	CC-6		4	28.0		300	.92	6
7	Position	6-8	87		15 o	S-8	S.C.Bay.	C-2R	1-1/8	2	6.75	2.04	300	.021	7
8	Position	6-8	1506 ⁽²⁾		24 o	GG-10 ⁽²⁾	S.C.Index.	CC-6		2-3/16	6.4	3.48	300	.019	8
9	Position	12-16	93		15 o	S-8	S.C.Bay.	C-2R	1-1/8	2	12.8	1.15	500	.021	9
10	Position	12-16	1512 ⁽²⁾	AN3122-1512	24 o	GG-10 ⁽²⁾	S.C.Index.	C-2R		2-3/16	12.8	1.6	300	.019	10
11	Position	12-16	1143		32 o	RF-11	S.C.Bay.	C-2R	1-1/4	2-1/4	12.5	2.13	400	.022	11
12	Position	12-16	1747	AN3133-1747	50 o	S-11	S.C.Bay.	C-2V	1-1/4	2-3/8	12.5	3.6	300	.022	12
13	Position	24-28	1524 ⁽²⁾	AN3122-1524	24 o	GG-10 ⁽²⁾	S.C.Index.	CC-6		2-3/16	28.0	0.83	300	.019	13
14	Position	24-28	315 ⁽²⁾		32 o	S-8	S.C.Bay.	C-2V	1-1/8	2	28.0	1.03	300	.021	14
15	Position	24-28	311	AN3133-311	50 o	S-11	S.C.Bay.	C-2V	1-1/4	2-3/8	28.0	1.55	300	.021	15
16	Interior	6-8	63		3 o	G-6	S.C.Bay.	C-2R	3/4	1-7/16	7.0	0.73	1000	.012	16
17	Interior	6-8	81		6 o	G-6	S.C.Bay.	C-2R	3/4	1-7/16	6.5	1.14	500	.012	17
18	Interior	6-8	87		15 o	S-8	S.C.Bay.	C-2R	1-1/8	2	6.75	2.04	300	.021	18
19	Interior	6-8	1129		21 o	S-8	S.C.Bay.	C-2V	1-1/4	2	6.4	2.91	200	.021	19
20	Interior	6-8	1725		50 o	S-11	S.C.Bay.	C-2V	1-1/4	2-3/8	5.5	6.95	100	.022	20
21	Interior	12-16	77	AN3141-77	3 o	G-5	S.C.Bay.	C-2V	11/16	1-3/8	13.0	0.41	1000	.012	21
22	Interior	12-16	89	AN3131-89	6 o	G-6	S.C.Bay.	C-2R	3/4	1-7/16	13.0	0.63	750	.012	22
23	Interior	12-16	1141	AN3124-1141	21 o	S-8	S.C.Bay.	C-2R	1-1/4	2	12.8	1.5	500	.021	23
24	Interior	12-16	1141SB ⁽¹⁾	AN3124-SB1141	21 o	S-8	S.C.Bay.	C-2R	1-1/4	2	12.8	1.5	500	.021	24
25	Interior	12-16	1747	AN3133-1747	50 o	S-11	S.C.Bay.	C-2V	1-1/4	2-3/8	12.5	3.6	300	.022	25
26	Interior	12-16	1747SB ⁽¹⁾	AN3133-SB1747	50 o	S-11	S.C.Bay.	C-2V	1-1/4	2-3/8	12.5	3.6	300	.023	26
27	Interior	24-28	301	AN3141-301	3 o	G-5	S.C.Bay.	C-2	11/16	1-3/8	28.0	0.19	500	.012	27
28	Interior	24-28	303	AN3131-303	6 o	G-6	S.C.Bay.	C-2	3/4	1-7/16	28.0	0.34	500	.012	28
29	Interior	24-28	307	AN3124-307	21 o	S-8	S.C.Bay.	C-2V	1-1/8	2	28.0	0.75	300	.021	29
30	Interior	24-28	307SB ⁽¹⁾	AN3124-SB307	21 o	S-8	S.C.Bay.	C-2V	1-1/8	2	28.0	0.75	300	.021	30
31	Interior	24-28	311	AN3133-311	50 o	S-11	S.C.Bay.	C-2V	1-1/4	2-3/8	28.0	1.55	300	.021	31
32	Interior	24-28	311SB ⁽¹⁾	AN3133-SB311	50 o	S-11	S.C.Bay.	C-2V	1-1/4	2-3/8	28.0	1.55	300	.022	32
33	Interior	24-28	1385 ⁽²⁾		20 W	R-12 ⁽²⁾	S.C.Bay.	CC-8		2-5/8	28.0	0.79	300	.026	33
34	Interior ⁽⁶⁾				6 W ⁽⁹⁾	T-5	Min.Bipin			9					34
35	Interior ⁽⁶⁾				8 W ⁽⁹⁾	T-5	Min.Bipin			12					35
36	Interior ⁽⁶⁾				14W ⁽⁹⁾	T-12	Med.Bipin			15					36
37	Interior ⁽⁶⁾				15W ⁽⁹⁾	T-8	Med.Bipin			18					37
38	Interior ⁽⁶⁾				30W ⁽⁹⁾	T-8	Med.Bipin			36					38
39	Indicator or	6	328	AN3140-328	.20A	T-1-3/4	Mid.Flange	C-6	3/8	5/8	6.0	0.22	500	.0012	39
40	Instrument	6-8	44		.25A	T-3-1/4	Min.Bay.	C-2R	3/4	1-3/16	6.3	0.275	3000	.006	40
41	Instrument	6-8	63		3 o	G-6	S.C.Bay.	C-2R	3/4	1-7/16	7.0	0.73	1000	.012	41
42	Instrument	6-8	81		6 o	G-6	S.C.Bay.	C-2R	3/4	1-7/16	6.5	1.14	500	.012	42
43	Indicator or	14	330		.08A	T-1-3/4	Mid.Flange	C-2V	3/8	5/8	14.0	0.09	350	.0012	43
44	Instrument	12-16	77	AN3141-77	3 o	G-5	S.C.Bay.	C-2V	11/16	1-3/8	13.0	0.41	1000	.012	44
45	Instrument	12-16	89	AN3131-89	6 o	G-6	S.C.Bay.	C-2R	3/4	1-7/16	13.0	0.63	750	.012	45
46	Instrument	12-16	1816 ⁽³⁾	AN3121-1816	.33A	T-3-1/4	Min.Bay.	C-2V	5/8	1-3/16	13.0 ⁽⁵⁾	0.38	1000	.006	46
47	Instrument	12-16	F3BP12/360BL		3W	RF-12	D.C.Index.			2-9/16			200	.026	47
48	Indicator or	24-28	327	AN3140-327	.04A	T-1-3/4	Mid.Flange	C-21	3/8	5/8	28.0	0.048	350	.0012	48
49	Instrument	24-28	301	AN3141-301	3 o	G-5	S.C.Bay.	C-2	11/16	1-3/8	28.0	0.19	500	.012	49
50	Instrument	24-28	303	AN3131-303	6 o	G-6	S.C.Bay.	C-2	3/4	1-7/16	28.0	0.34	500	.012	50
51	Instrument	24-28	313 ⁽³⁾	AN3121-313	.17A	T-3-1/4	Min.Bay.	C-2	5/8	1-3/16	28.0	0.19	500	.006	51
52	Instrument	24-28	F5000	AN3125-F5000	4W	RF-12	D.C.Index.			2-9/16			200	.026	52
53	Instrument	24-28	F2T6/BL		2W	T-6	D.C.Index.			2-3/8	(6)		200	.022	53
54	Signalling	12-16	4500	AN3126-4500	6.6A	PAR-36	So.Term.	5C-8		2-5/8	13.0		50	.52	54
55	Signalling	24-28	4501	AN3126-4501	5.3A	PAR-36	So.Term.	4CC-8		2-5/8	26.0		50	.52	55

(1) Silvered Bowl

(2) Reflectorized bulb

(3) Recommended only for intermittent use

(4) Under specified test conditions

(5) For operation with resistance ballast on 12-16 volt D.C. circuits

(6) For operation with resistance ballast on 24-28 volt D.C. circuits

(7) For horizontal burning only

(8) Fluorescent lamp to be used with auxiliary of proper design. Does not operate satisfactorily over the temperature range required for military aircraft.

(9) Soft white color

Bendix Products Division

FIRST IN

FUEL METERING

From the Fastest to the Largest!

The outstanding ability of Bendix Products in keeping pace with aviation progress is graphically demonstrated in the scope of its accomplishments.

Bendix fuel metering systems on the latest and fastest jets, for example, are meeting conditions undreamed of a few years ago. Today the world's largest land plane is brought to a smoother sure stop with Bendix landing gear.

The fact that the experience and skill of Bendix Products are constantly utilized in record breaking achievements is ample evidence of its capacity to serve the practical needs of engine builders and airplane manufacturers.

Why not let this combination of engineering experience and manufacturing know-how help solve your fuel metering and landing gear problems.

LEADER IN

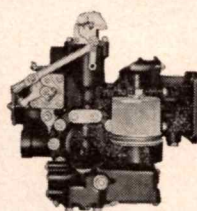
LANDING

GEAR

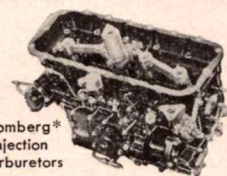
BENDIX PRODUCTS DIVISION of
SOUTH BEND 20, INDIANA



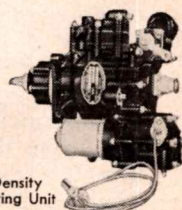
Export Sales: Bendix International Division, 72 Fifth Ave., New York 11, N.Y.



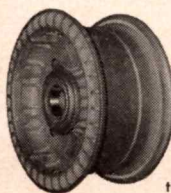
Fuel Metering Unit
for jet engines



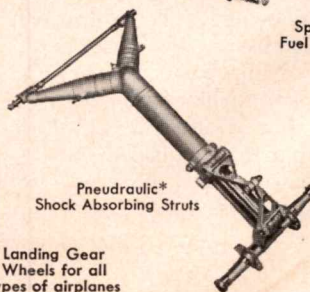
Stromberg*
Injection
Carburetors



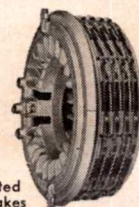
Speed-Density
Fuel Metering Unit



Landing Gear
Wheels for all
types of airplanes

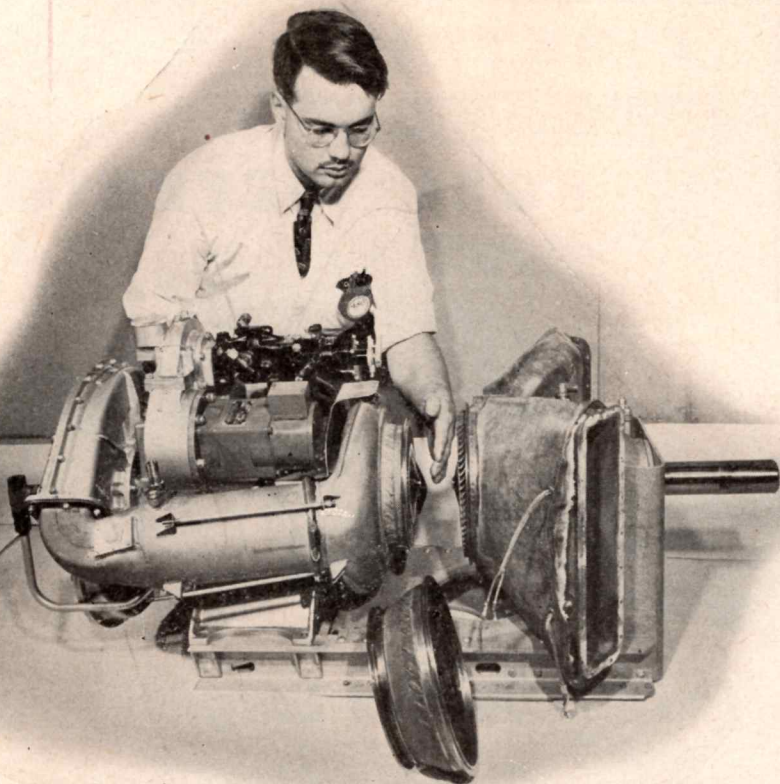


Pneumatic*
Shock Absorbing Struts



Segmented
Rotor Brakes

*REG. U. S. PAT. OFF.



Boeing 502-1-1 gas turbine of 160 shaft hp has separate gas-producing and power-output sections that give infinitely variable power transmission

GAS-TURBINE AUXILIARY POWERPLANTS

PAUL H. WILKINSON
Powerplants Editor

GOOD things come in small packages! This axiom readily applies to the crop of miniature gas turbines now being developed and placed in production for driving auxiliary equipment of all kinds on land, on water and in the air. Much of the progress made with these small engines has been due to Government sponsorship, although individual enterprise has also played an important part. The need for larger gas-turbine units to replace the smaller piston-engined outfits which proved so useful during the War was evident, and now that these new powerplants are available, undoubtedly they will find a ready market.

Four auxiliary gas turbines ranging in power output from 85 to 210 shaft hp are described in this article. Design features show that for the most part their components have been

copied from the larger gas turbines used for aircraft propulsion. Innovations in these miniature powerplants include coupled power sections,

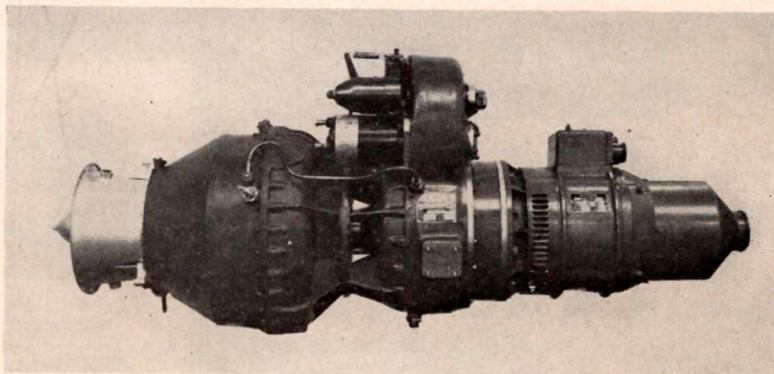
a radial-flow turbine rotor, separate gas-producer and power-output sections, and a low-pressure, centrifugal fuel injection system.

The largest of these new gas-turbine units is the Solar Model 80, designed and built by the Solar Aircraft Co. to supply the needs of the Air Force for an independent and constant source of electric power for its long-range, high-altitude bombers. The M-80 comprises two separate gas-turbine power sections mounted in a single assembly, with a common reduction gearbox connecting them with an electric alternator. Hydraulically operated isolating clutches enable either power section to drive the alternator. One power section, developing 105 shaft hp at sea level, is sufficient to drive the alternator at low altitudes, but the two units with a combined output of 90 shaft hp at 40,000 ft are required to drive the alternator at high altitudes without loss in electrical output.

Conventional Construction

The construction of the Solar M-80 power sections is conventional. Each embodies an axial-type compressor with nine stages, two can-type combustion chambers and a two-stage, axial-type turbine. In order to reduce over-all length, the combustion chambers are mounted alongside the compressor casing which necessitates having the air intakes arranged radially around the mid-section of the engine, just ahead of the turbine casing. The air flow is directed forward into the compressor and, after compression to four atmospheres, its flow is reversed by a diffuser backward into the combustion chambers.

The compressor rotor is of the built-up type comprising nine aluminum-alloy disks with blades of the same material, clamped together with end shafts mounted in two anti-friction bearings. The combustion chambers are of tubular construction, quickly removable, with fuel injectors mount-



Turbomeca TT-782 gas turbine produced in France has an annular flame tube and low-pressure centrifugal fuel-injection system. It gives 140 shaft hp and has passed French Air Ministry test

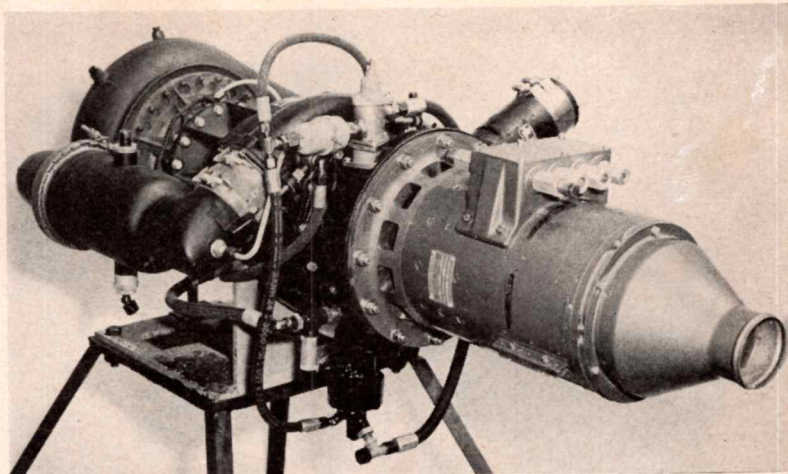
ed in the compressor diffuser elbows to which the combustion chambers are attached. The turbine has a single over-hung disk with two rims to which solid blades of special heat-resistant alloy are welded. The turbine shaft is mounted in two anti-friction bearings, one of which takes the thrust, and is joined to the compressor rotor shaft by a splined coupling. The exhaust nozzle is of the fixed area type.

Fuel and Lubrication Systems

The fuel system includes an Eclipse-Pioneer fuel pump with a maximum pressure of 600 *psi*; with overspeed governor and manually operated throttle for starting. The lubrication system operates on the dry-sump principle, with pressure feed to the bearings, clutches and gears at a pressure of 25 *psi*. Starting is accomplished by means of an EEMCO reversible electric motor mounted on the main gearbox where it can engage the drive-shaft of either power section through bevel gears and overrunning clutches.

The Leland electric alternator is mounted between the power sections, and is of 50-*kw* capacity supplying current at 120/208 volts, 400 cycles *a.c.*, with its output constant to 40,000 *ft*. The overload capacity is 75 *kw* for five minutes. A remote control system is provided for starting, loading, paralleling, dividing loads and stopping. Each power section is rated at 105 shaft *hp* at 24,000 *rpm* at sea level, and the weight of the complete dual assembly unit is 370 *lbs*.

The AiResearch Manufacturing Co.



AiResearch GTPU-7C gas-turbine power unit of 85 shaft *hp* has radial air-intake ports and radial-flow turbine rotor of new design. Other modifications can be used for engine starting or ground heating

has announced two auxiliary gas turbines and is working on others under Navy contracts. The oft-described GTC-43-44 unit with over-size compressor, from which high-pressure air is bled to drive pneumatic turbine-type motors for starting turbojets and turboprops, was the original model. (See "Jet Engine Starter"; page 37, *AERO DIGEST*, Feb. 1949.) This unit has a rating of 65 shaft *hp* at 40,000 *rpm* at sea level, and weighs 88 *lbs*. Similar to it in many respects, but with a regular size compressor and driving an electric generator, is the newer GTPU-7C model which comprises a two-stage centrifugal compressor, two can-type combustion chambers, and a single-stage, radial-type

turbine of novel design.

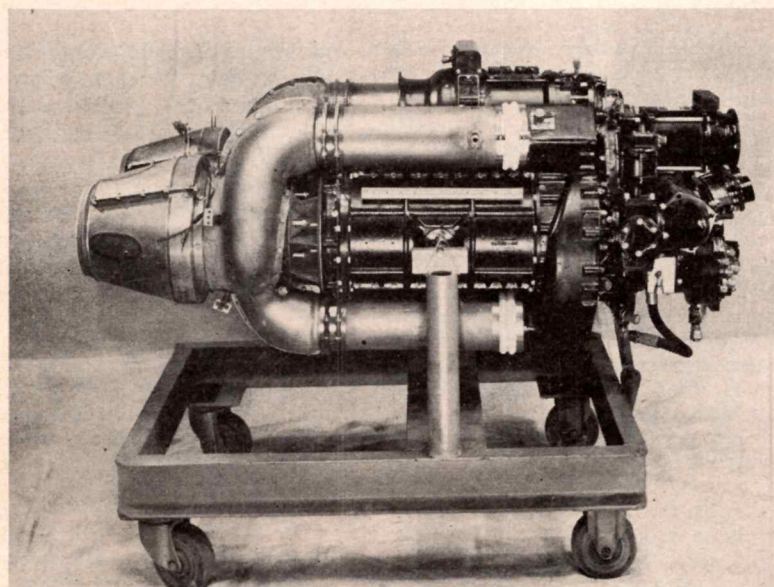
Air enters the GTPU-7C power section through radial intakes, peripherally arranged around the mid-section, and passes forward through the compressor. The combustion chambers have integral diffuser elbows by which they are attached to the tangential outlets of the compressor. The fuel injectors are mounted in the elbows. The turbine has a radial-type rotor with vanes which direct the gases from the rim of the disk inwardly to an outlet around the central shaft. The exhaust nozzle is of the fixed-area type.

A single gear-type, high-pressure pump supplies the fuel; the lubrication system is dry sump, operating at a pressure of 75-100 *psi*. A 3/4-*hp* electric motor starts the engine which is provided with a manually operated starting throttle and an automatic control. The air-cooled electric generator is of Westinghouse manufacture, with a capacity of 19.2 *kw* at 24 *v*, 800 *amps d.c.* The turbine is rated at 85 shaft *hp* at 40,000 *rpm* at sea level; the weight of the complete assembly is approximately 200 *lbs*.

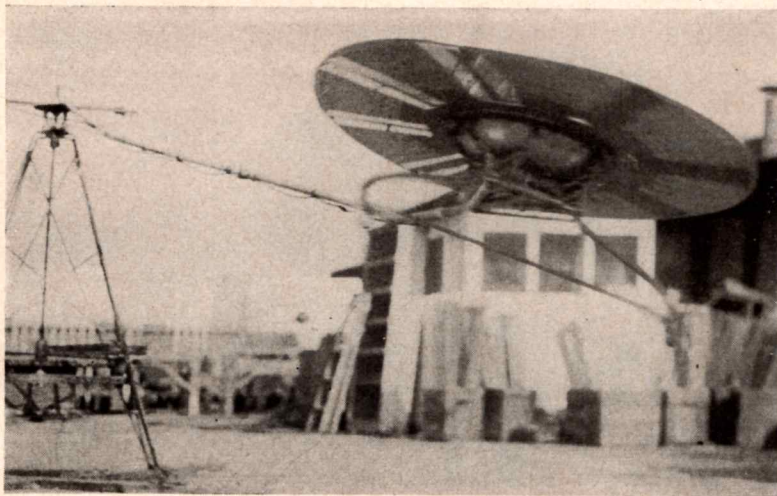
The Air Force Wants Them

AiResearch recently received a contract from the Air Force for a considerable number of special ground-heater units embodying the essential components of this auxiliary gas-turbine power unit. These heaters will be used in the Arctic for pre-heating aircraft engines and equipment, and for heating living quarters. The unit has six adjustable outlets allowing several different heating operations to be performed at the same time, and provides 4,000,000 *Btu* per hour on a -65°F day at a temperature of 150° to 280°F.

Thus far, the Boeing Airplane Co.
(Continued on page 134)



Solar M-80 gas turbine, comprising two coupled turbine units mounted in a single assembly, drives electric alternator through a common reduction-gear box and provides constant electrical output at high altitudes for Air Force long-range bombers. Each unit delivers 105 shaft *hp* at sea level. Combined output is 90 shaft *hp* at 40000 *ft*



Left—Dr. Kay's flying disk shown undergoing test on a whirling arm simulating forward flight conditions. Maximum lift obtained was at about 18° blade pitch in this type test. Below—Dr. Eugene W. Kay, San Francisco engineer and designer, shown studying his experimental flying disk. Prototype model is about 5 ft in diameter and weighs 11 lbs 3 oz

IN JUNE 1947, an Idaho business man named Kenneth Arnold looked from his private plane and spotted a string of saucer-like objects playing tag with the jagged peak of Mt. Ranier at what he described as "fantastic speed." Arnold's remarks set off a chain reaction.

Reports of "flying saucers" began to come in from all parts of the country and abroad. Observers reported that they had seen flying "chromium hub caps"; "dimes"; "tear drops"; "gas lights"; "ice cream cones"; and "pie plates." There have appeared since that date many newspaper and magazine stories about the "Flying Saucer," and the Air Materiel Command at Wright Field made an exhaustive investigation under the heading "Unidentified Aerial Phenomena, Project Saucer," issuing digest of its studies.

Is there anything to the Flying Saucer? Let's examine the question with elementary aerodynamics as one approach; rough-and-ready psychology as another.

Suppose that the Flying Saucer is a product of hostile human or Martian intelligence. Would its designers use the form of a disk for their craft?

(1) Assume that the craft is a species of not-too-speedy airplane. The aspect ratio of a circular disk by standard

$$\text{formula is } \left[\frac{D^2}{\pi D^2/4} \right] = \frac{4}{\pi} = 1.27, \text{ a}$$

low value which leads to high induced drag. The sole advantage of the low aspect ratio is delaying the stall to as much as 30°. Aircraft with circular wings have been built several times—by S. P. Nemeth in Chicago for example. They have been abandoned, no doubt because of their inefficiency.

(2) Now suppose the flying saucer is intended for transonic or even supersonic speed. The induced drag of low aspect ratio are no longer important; shock wave losses are the things to avoid. But to reduce shock losses, the

airfoil should be then swept back, or be of delta of triangular form, certainly not a circular disk.

(3) What if the disk is a helicopter? The speed and load-carrying limitations of a helicopter are well known. Why use the helicopter in such a peculiar undertaking?

(4) Now let us turn to the convertible aircraft, which is so fashionable to debate. Here the objection is: if you want to build a small, high-speed device to fly over country for reconnaissance or for destructive purposes, why go to all the troubles of a convertible aircraft? Surely it would be much simpler to launch a tiny, appropriately-designed airplane from some mother aircraft.

(5) If the curious device is to be rocket-propelled, then we know perfectly well that a circular disk is not the aerodynamic form that is suited to rocket power.

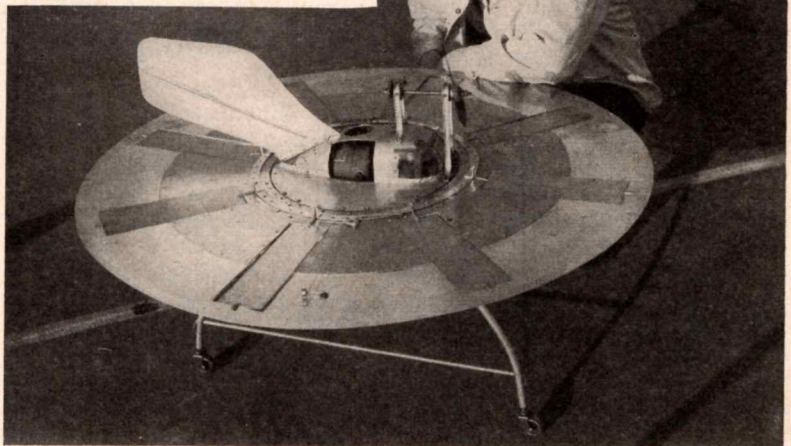
Dr. Jerome C. Hunsaker said wisely on some occasion that engineers, of no matter what country, working on a

particular problem, would come eventually to about the same solution. Americans, Russians, Martians working to meet the purposes of a flying saucer (at which we can only guess) all probably would come to an aerodynamic form other than the circular disk.

In considering electromagnetic possibilities, we can do no better than quote from the Wright Field report:

"The possibility that the saucers were supported by means of rays or beams was investigated and debunked. By rays or beams is meant either purely electromagnetic radiation or else radiation which is largely corpuscular, like cathode rays, cosmic rays or electron beams. Any device thus propelled would have to be fundamentally a reaction device. The basic theory of such devices is that a given amount of energy is most efficiently spent if the momentum thrown back or down is large. This means that a large mass should be given a small acceleration, a theorem well

(Continued on page 129)



THE FLYING SAUCER

DR. ALEXANDER KLEMIN

Technical Editor



SPACE and TIME EATER

First, the windy emptiness of Kitty Hawk where two brothers changed the outlook of a world. Later the thrilling words at Le Bourget, "I am Charles Lindbergh." And then, Odom's 73-hour shrinkage of the globe. Tomorrow, instead of the propeller, you will hear the roar of jet power breaching the wall of sound.

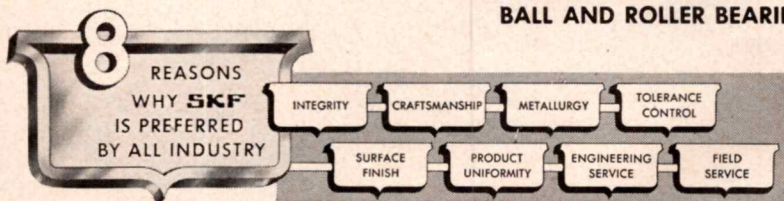
These and a hundred other milestones are pure drama. But they have led aviation into big business—eating space and time for freight and passengers all over the world.

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Pioneers of the Deep Groove Ball Bearing—Spherical Roller Bearing—Self-Aligning Ball Bearing.

New Russian Service Fighter

WILLIAM GREEN

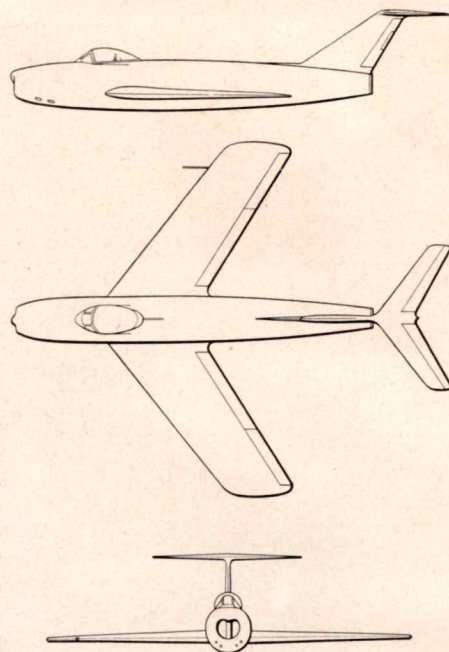
FOR a number of years, the Soviets have covered their military aircraft with a cloak of secrecy and it is only on rare occasions that a tear in the cloak's fabric provides concrete evidence upon which can be gaged the extent of progress in high-speed combat-aircraft design behind the Iron Curtain. It recently became known that a new, advanced fighter is coming into service with certain first-line fighter elements of the Russian Air Force, an aircraft that typifies the tremendous advances made by Russia in the design of jet fighters since the appearance of such types as the Mig-9 and Yak-15. This fighter is depicted in the accompanying well-substantiated drawings, based on enlarged tele-

photo films from Polish sources.

Reports vary regarding the design origin of this fighter, some crediting it to A. S. Yakovlev, the prolific designer whose research monoplane is claimed by the Russians to have exceeded Mach 1 by a handsome margin, and labeling it Yak-21. Other sources believe the fighter to have originated in the design office of S. A. Lavochkin, well-known for his series of piston-engined fighters such as the La-11 with which most Russian fighter groups based in the Russian zone of Germany are equipped. However, although there may be some doubt as to the design origin of the new fighter, there can be no doubt at all that it denotes a radical change in Russian design technique, a change influenced in no small part by the German airframe designers who are working side-by-side with their Russian contemporaries.

Three of the new fighters flew over Moscow on Soviet Aviation Day in August last year, and, since that time, numerous observers have reported seeing formations of the type which is believed to be used by a number of fighter elements based around Moscow.

Russia's immediate post-war jet fighters embodied nothing sensational from the design aspect, being of a standard attained by the Germans during 1941-43. The greatest obstacle in the way of the development of a high-performance fighter as ef-

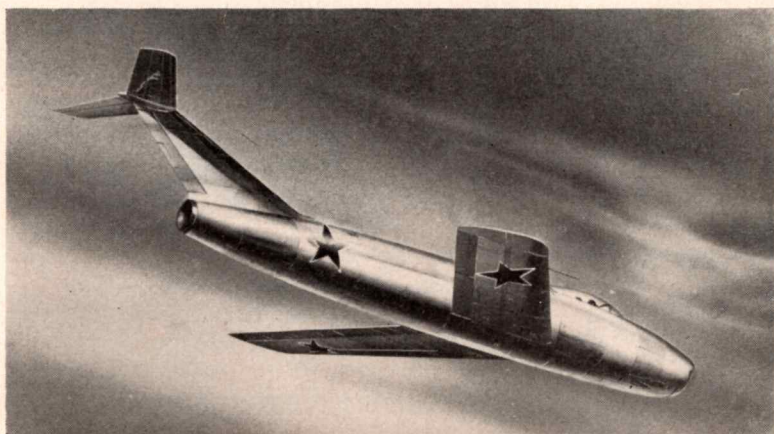
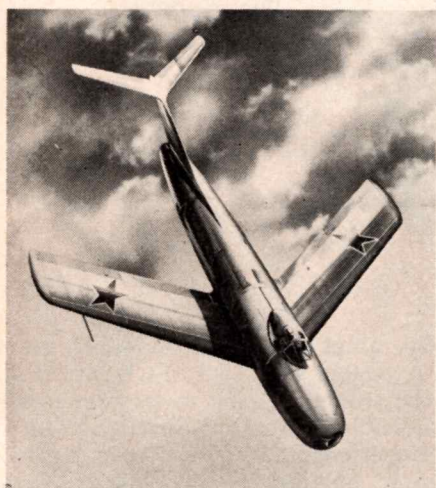


ficient or superior to those in service with the Western Powers was the lack of a really efficient and powerful turbojet.

Having the services of topline German designers at their disposal, the Russians found that they could produce advanced airframes; but the only propulsive units available, (the M-003 and M-004) developments of turbojets that existed in Germany at the end of the war, were notorious for their poor thrust and high expendability. The answer to this problem was obtained from the last source to which Russia looked for help. The origin of this "timely" assistance was Great Britain, who furnished the highly-delighted Russians with 55 Rolls-Royce turbojets of the *Derwent* and *Nene* type.

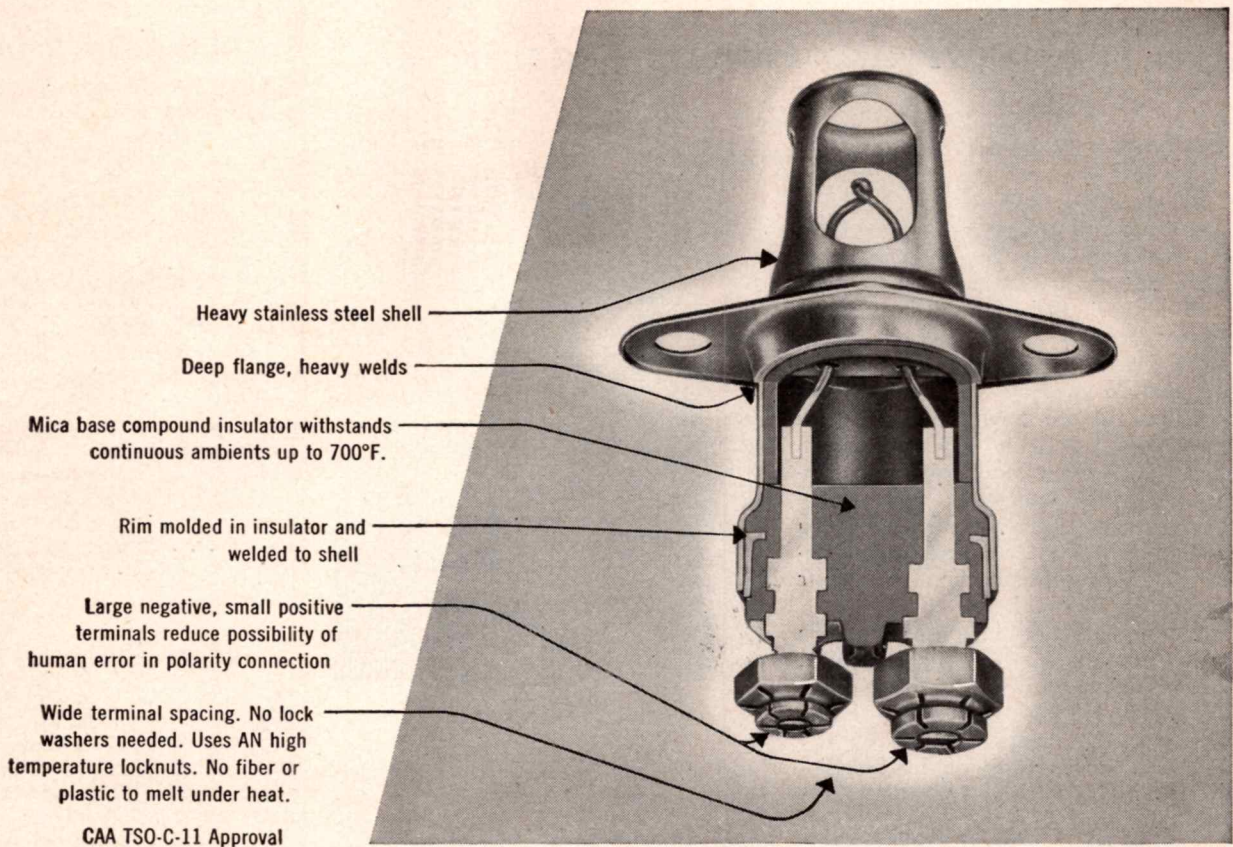
Both the *Derwent* and *Nene* are simple centrifugal compressor-type engines, well suited to Soviet mass-production methods. In the two years that have elapsed since the importation of these turbojets, Russian engineers are certain to have adapted one or both for home production and doubtless have improved the original outputs by such means as after-burning or water-injection with which the Germans were experimenting at the end of the war.

Reports indicate that the new fighter illustrated here is powered by a Russian adaptation of the Rolls-Royce *Nene*. The fuselage shape supports this contention by suggesting the use of a centrifugal turbojet, whereas all known Russian jets are of axial-flow design. Russian *Nenes* are quite likely to be giving something more than 5000 lbs static thrust, though periods



Identity of this new Russian jet fighter is lacking, but its existence in quantity production and operation is fact. May be Lavochkin or Yak-21

(Continued on page 134)



Cutaway view enlarged to show detail, Pat No. 2485468

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INSTRUMENT DIVISION

THOMAS A. EDISON,

INCORPORATED

IAS Meeting Honors Lederer

THE 1950 annual meeting of the Institute of the Aeronautical Sciences, held in New York the last week of January, was well attended and proved to be the customary huge success.

Although the technical sessions opened with a number of significant papers on rotary-wing aircraft, among the 40-odd presented the greater accent was placed upon discussions on aerodynamics, with repeated references to designs and problems connected with supersonic and hypersonic flight. Aero-elasticity came in for an especially comprehensive discussion during the presentation of four papers on the subject.

Instruments and meteorology were given one-half day of attention each. Powerplants received relatively little treatments, formal discussions being limited to a morning session on the last day, which dwelt on jet installation-design problems from the viewpoints of aircraft designer and engine manufacturer.

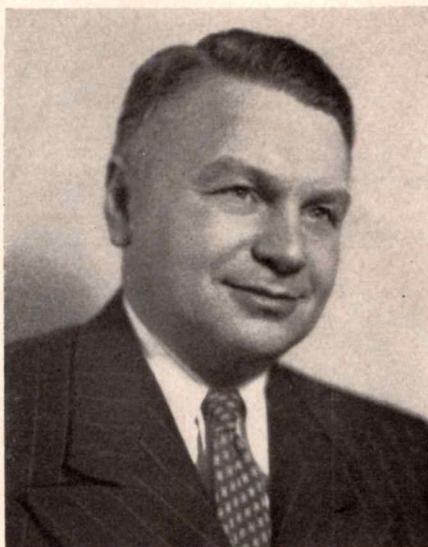
Discussions on air transport—in cooperation with the Flight Safety Foundation—revolved around the maintenance of safety attitudes, crash and fire prevention and the service-testing of prototype transports.

At the annual Honors Night dinner, Jerome Lederer received a special IAS Council certificate, "for his outstanding contributions in engineering for flight safety and for his untiring efforts to encourage research in this field." Lederer, well known as a practicing aeronautical engineer, is director of the Flight Safety Foundation, a non-profit, independent organization in New York. He is also technical adviser to U. S. Aviation Underwriters.

The John Jefferies Award was presented to Arnold D. Tuttle, Medical Director, United Air Lines, "for outstanding contributions to the advancement of aeronautics through medical research." The Robert M. Losey Award went to William Lewis, meteorologist, U. S. Weather Bureau, "in recognition of outstanding contributions to the science of meteorology as applied to aeronautics."

George S. Schairer, Staff Engineers, Aerodynamics and Powerplant, Boeing Airplane Co., received the Sylvanus Albert Reed Award "for his analytical and experimental work contributing to the design and development of large, sweptwing, high-speed aircraft."

The Lawrence Sperry Award was bestowed upon Alexander H. Flax,



Jerome Lederer

head of the Aero-mechanics Department, Cornell Aeronautical Laboratory, "for significant additions to the methods available for determining dynamic behavior of airplanes, helicopters and missiles."

Confer on Air Safety

A CONFERENCE on air-travel safety will be held March 31 as part of the Greater New York Safety Council's 20th annual Safety Convention and Exposition. Jerome Lederer, president, Flight Safety Foundation Inc., will preside over the gathering.

Presentations on specific phases of air-travel safety problems will be made by Sigmund Janas, Colonial Airlines; Samuel Pryor, PAA; and Robert Knight, AOA.

In the Public Interest

SIGMUND JANAS, president of Colonial Airlines, Inc., has instructed his attorneys to dismiss the suit in the Supreme Court by Colonial Airlines against the Civil Aeronautics Board and its members. The suit charged that an economic injury has been done to Colonial by the proposed grant to Trans-Canada Airlines of parallel operation between Montreal and New York, without other route compensation to Colonial.

Janas stated: "With the increasing gravity of the international situation we have concluded that it would not be right, in the public interest to challenge the power of the Government to make executive agreements with foreign powers. It is hoped, however, that additional air routes to which Colonial is clearly entitled, and which would unquestionably be in the public interest, will be granted . . . Colonial will continue its efforts to secure this relief which it needs and must have."

More Private Flying

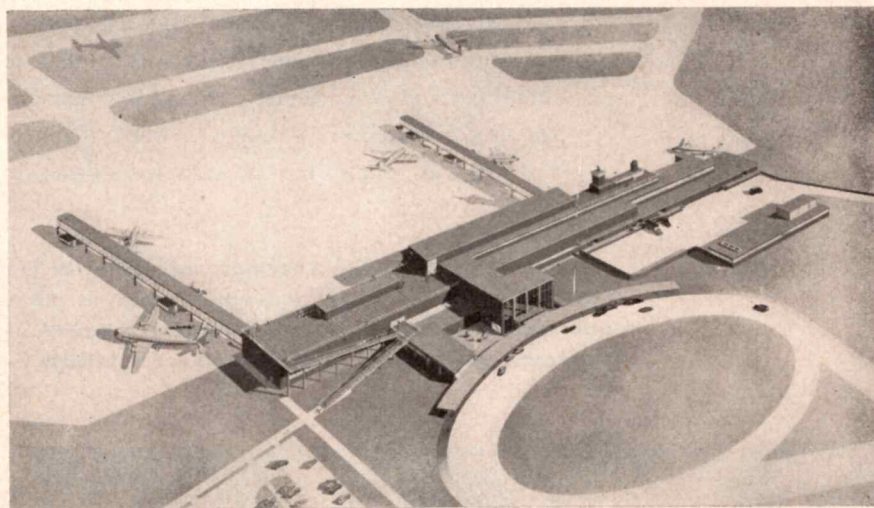
ACCORDING to a report from the Illinois Dept. of Aeronautics, 9,676 pilots and 3,565 aircraft owners registered their Federal certificates with the state of Illinois in 1949. This represents an increase of 193 pilots and 20 aircraft over 1948.

Women pilots registered numbered 292, along with 44 helicopter and 161 glider pilots.

- Passenger traffic mail and freight continued to show a steady increase at Los Angeles International Airport during 1949, despite an 8% reduction in aircraft movements.

- The Wisconsin Aeronautics Commission has published a new *Official Wisconsin Airport Map*, showing location and type of the state's landing facilities.

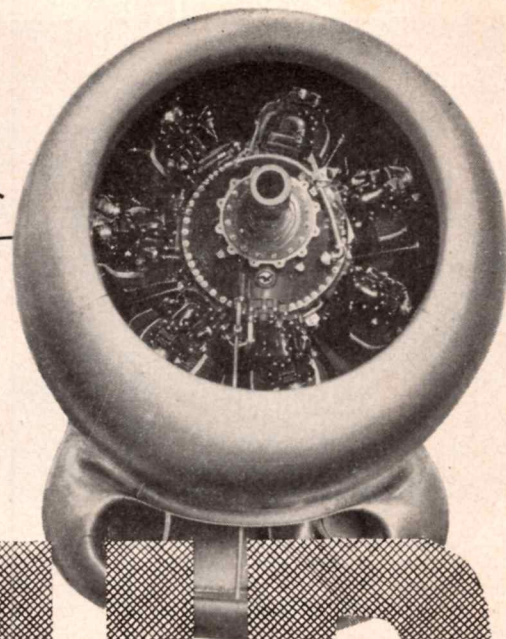
- The 1950 annual business meeting of the American Assn. of Airport Executives, to be held in April, has been labelled "Operation Cooperation." Airport executives and top airline representatives will take part in the forum and discussions.



Sixty-million dollar terminal soon to be built at Philadelphia Southwest International Airport. Engineered and designed under the direction of Airways Engineering Corp, with Carroll, Grisdale and Van Alen as associates, the building will accommodate 17 aircraft simultaneously and can be enlarged to accommodate 30

Power package for the B 50 completely built and assembled by Rohr

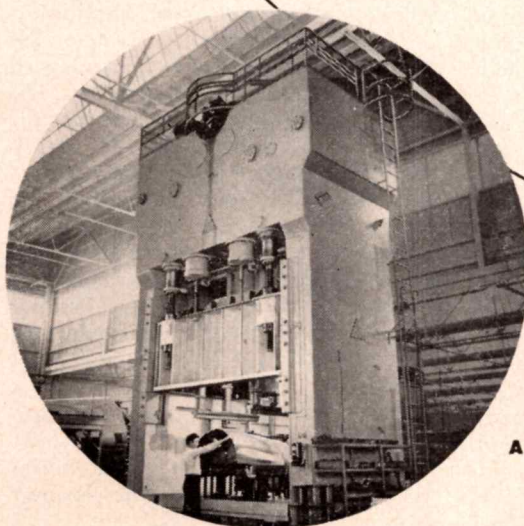
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Left to right—Dr. Alexander Klemm, Dr. Harry F. Guggenheim and Dr. Hugh L. Dryden as they received Doctor of Engineering degrees from New York University. Dr. Klemm also holds a BS degree from University of London, an MS in Aeronautical Engineering from MIT and an LLD from Kenyon College, Ohio

DR. KLEMM HONORED

AERO DIGEST'S Technical Editor receives honorary degree for service to nation's first school of aeronautics

THE 25th anniversary of New York University's Guggenheim School of Aeronautics—claimed to have been the first in the country—was observed fittingly on the Hall of Fame campus by presenting honorary degrees of Doctor of Engineering to Harry F. Guggenheim, who was instrumental in establishing the school in 1925, and to Dr. Alexander Klemm, who lectured on aviation at the University in earlier years and guided the Guggenheim School of Aeronautics for practically two decades.

Other honorary degrees were awarded at the same time to Dr. Hugh L. Dryden, director of the NACA, and to Robert Moses, New York City Park Commissioner and developer of the city's airport and airport-access programs at LaGuardia and Idlewild Airports.

During the exercises, Dr. Klemm was lauded for: "his inspiration and untiring efforts; he brought the reputation of the institution to top-ranking position in this country. He designed the original double-return wind tunnel, which was then the largest non-governmental wind tunnel in the U.S.; he developed a moving belt to simulate ground effects for stationary models in the wind tunnel since it was not feasible to move the model. He designed a mirror-pitot to measure air speed in flight more accurately; an experimental rig for measuring spin-

ning characteristics of airplanes in a horizontal tunnel; and a testing apparatus for autogyro models to eliminate scale effects. Klemm also was instrumental in developing a power-plant laboratory, a towing basin and other aeronautical developments of the school."

He Enjoyed It

Dr. Klemm responded by saying that a reward was hardly necessary, "because I made many friends and enjoyed the intellectual excitement of delving into almost every phase of scientific aeronautics. But rotary wings came closest to my heart.

"When this school was still in an embryonic stage, I wrote the first American technical paper on the helicopter and presented it at the mid-November 1924 Meeting of the ASME. It was the Daniel Guggenheim School that offered, in 1937, the first course in the world on the theory of rotary wings, and the graduates of this school lead in the technology of the helicopter as chief engineers and directors of research in every important organization in the country.

"In the Los Angeles area, the carrying of mail by helicopter from airport to the post offices has proved astoundingly successful. Such a service will come to every great center of population, and most certainly to New York City. The helicopter will connect Idle-

wild with LaGuardia and Newark Airport and all three airports with the main post office; with Westchester County and Southern Connecticut.

"The Post Office Department opposes this service, with a voluminous study which proves that the truck, moving through New York's busy streets, is a better vehicle for the purpose. I have seen many such examples of the wrongheadedness of officialdom. An Assistant Postmaster General once stopped wheel brakes from being put on mail planes because, as he said, the airplanes would turn over on their noses, when the brakes were applied. There is today not a single airplane flying without wheel brakes.

"In 1910, an equally voluminous report by the British Lords of the Admiralty stated that the airplane had no offensive power, was useless in reconnaissance and deserved no further study by the British Navy. It was on the day when I read this report that I determined to make scientific aeronautics my life's work.

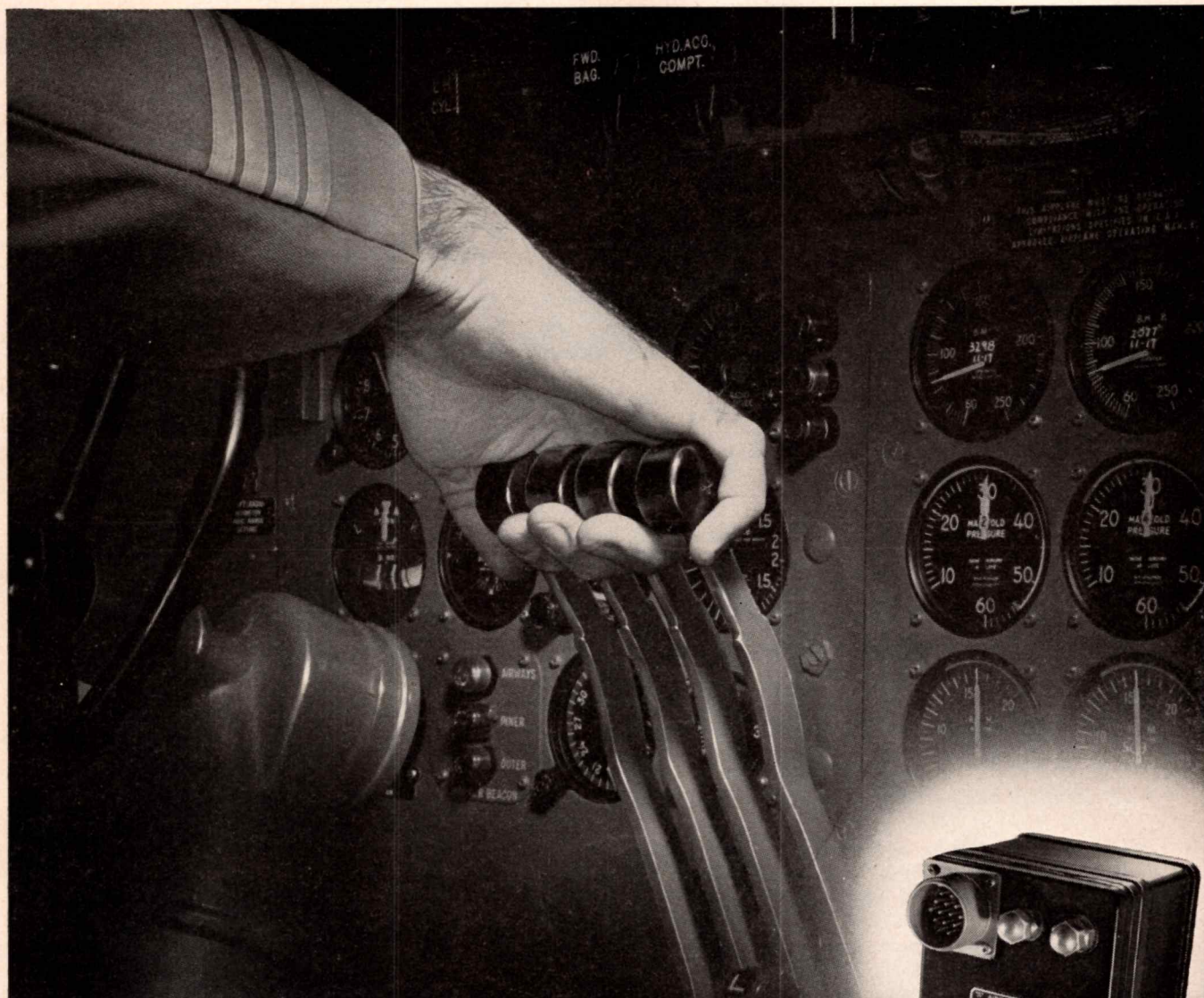
"I predict a great future for the 'convertiplane' or 'convertible aircraft,' whose first stages Gerard P. Herrick developed in the wind tunnel of the Guggenheim School. The convertiplane will combine the landing and takeoff capacities of the helicopter with almost all the speed of the airplane. What a specification this would be: 'Vertical climb, vertical descent, 50 passengers, cruise speed 400 mph.' It is also clear that not forever will helicopters employ mechanical transmission of power from a conventional engine. Eventually, jet thrust at the tips of the blades will be applied to every large and speedy helicopter.

"With equal assurance, I can say that the helicopter will be more and more useful in industrial and agricultural applications, in forest fire fighting, in rescue work by the Coast Guard, in traffic control by the police, in archaeology, in exploration, in a hundred useful peacetime activities.

"And how about the helicopter for private use? Private flying has lagged behind other phases of aviation. The main difficulty lies in the fact that the airplane can be used only after traveling some distance to an airport. Another difficulty is that, in landing, one has so little time to think about it. Accidents happen in landing—not in the air—and in the populous and hilly Eastern States, emergency landing fields are few and far between. All these difficulties the helicopter eliminates.

"Then where is the 'snag' that prevents the immediate use of the helicopter in private flying? In initial cost and in maintenance. The cheapest

(Continued on page 128)



FIRST "FAIL SAFE" ELECTRONIC CONTROL

Pilots on today's giant aircraft adjust engine throttles by means of elaborate remote control electronic systems.

Problem has been to devise an electronic control that would "fail safe" in case trouble developed anywhere in the system. In other words, controls that would stop and hold position at the exact moment of system failure.

Engineers at AiResearch have now perfected such an electronic control. This control has many applications in the regulation of pressure... temperature... and remote positioning. For the first time, it provides a "fail safe" method of electronic control.

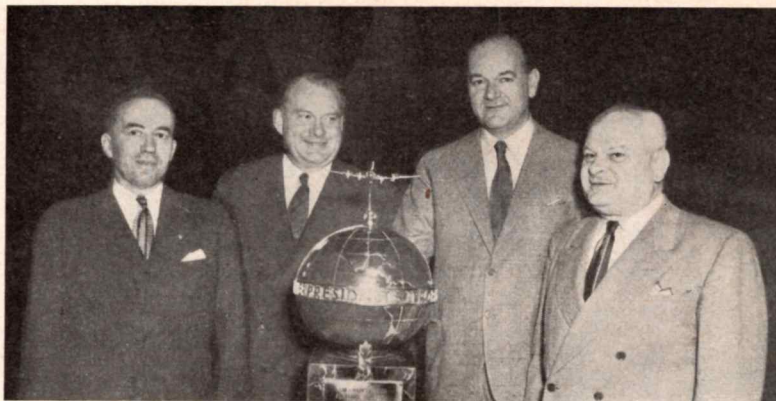
In addition, this new type of AiResearch electronic control is ultra sensitive. It makes possible the application of maximum power—or response to temperature or pressure changes—in almost microscopic degrees.

Such pioneering in the field of electronic development and manufacture is typical of the day-to-day operations of the skilled scientists and engineers at work at AiResearch.

• Whatever your field—AiResearch engineers—designers and manufacturers of rotors operating in excess of 100,000 rpm—invite your toughest problems involving high speed wheels. Specialized experience is also available in creating compact turbines and compressors; actuators, with high speed rotors; air, gas and liquid heat exchangers; air pressure, temperature and other automatic controls.



• • • • An inquiry on your company letterhead will receive prompt attention.
AiResearch Manufacturing Company
Los Angeles 45, California



C. R. Smith, presenting the "President's Trophy" to pilots of American Airlines' Eastern Region for completing 1949 without a casualty. Left to right: Tom Boyd, regional operations director; H. L. Clark, regional flight superintendent; Smith and Ora Young, Regional CAA Administrator

THE OUTLOOK

Leaders in the aviation industry note our present position and give us an inkling of what can reasonably be expected during the year

"It's good . . . Jets will stimulate"

B. N. SNOW

Vice-President in Charge of Sales, AiResearch Manufacturing Co.

IN GENERAL, our feeling is that the outlook for aircraft accessory manufacturers during the next year, and for some time beyond, is good. The pre-announced procurement of military aircraft for the 1950 and 1951 fiscal years, while much lower in total aircraft tonnage and a smaller number of aircraft than in 1949, will

still offer the designer and manufacturer of certain vital accessories ample opportunity for good business.

While the outlook for the commercial segment of the market is only fair at the present time for the accessory manufacturer, the advent of the first jet transports should stimulate this market within the next five years.

"We must catch up with England"

AUBREY KIEF

Chairman, Aviation Div., The Texas Co.

THE British are coming! Paul Revere's cry of alarm on the occasion of his famous ride might well be applied in the aviation industry today as far as development of jet powerplants for commercial application is concerned. The British already have prop-jet- and turbojet-powered commercial aircraft flying—and in Canada Avro built a jet-powered airliner.

So really, the British have come—they have arrived, so to speak, with a practical, jet-powered airliner. And it is high time that U. S. engine manufacturers were doing something.

And something is being done. Allison Division of General Motors Corp. has purchased a *Convair-Liner* for flight tests to accumulate data on the reliability and dependability of turbine-powered transport aircraft.

The Allison *Convair* will be equipped with two T-38 turboprop engines developing 2750 hp each. Other prominent aircraft engine manufacturers are building—or are about to build—the British *Nene* gas turbine and will have this type ready for operational proving in a commercial application before long. There is no doubt that turbine-powered aircraft are soon to be universally with us—and it is coming sooner than any of us thought.

The advent of this type of powerplant makes necessary the development of proper fuels and lubricants—and it is here that the petroleum industry will assume responsibility in the development and refining of jet fuels and lubricants. The Texas Company has assumed a most active role in this respect and is presently refining

JP-3 fuel and AN-O-9a-type jet-engine oils. The fuel is refined to meet both AN-F-32a, Grade JP-1, (which is known as Texaco 420 Jet Engine Fuel) and AN-F-58a, Grade JP-3, the latter available on special order for use by engine manufacturers.

During 1950 additional experimental work will be done to better the characteristics of the fuel to avoid vapor "boiling" at high altitudes and to conform to aromaticity requirements. The outlook is that some improvement can be expected.

Other major refiners are active in the development field and presently offer suitable products. Servicing equipment manufacturers are active in developing jet-engine starting units and jet-engine oil preheaters—the latter being an essential item in colder areas. During 1950 these equipment items will be perfected—and many new pet-engine accessory items will be developed.

As for fuels and lubricants for piston-type engines—there are continuous improvements, especially in detergent and compounded-type lubricating oils in betterment of the lower octane-bracket fuels for light engines—the tendency being to go away from an unleaded product to a leaded one with improved octane index on the rich-rating side. No doubt there will be a trend during 1950 for higher octane fuels with lower lead content and improved aromaticity characteristics. But the time approaches, within the next four years, when all new powerplants will be of the gas-turbine variety.

"Year of challenge"

EDMUND T. PRICE
President, Solar Aircraft Co.

AT SOLAR AIRCRAFT we look forward to 1950 as another year of challenges. There is a certain measure of satisfaction in this when we recollect that usually the years which at the start seemed most difficult were the most successful at the end. Achievements have a way of yielding satisfactions almost in direct proportion to the besetting difficulties.

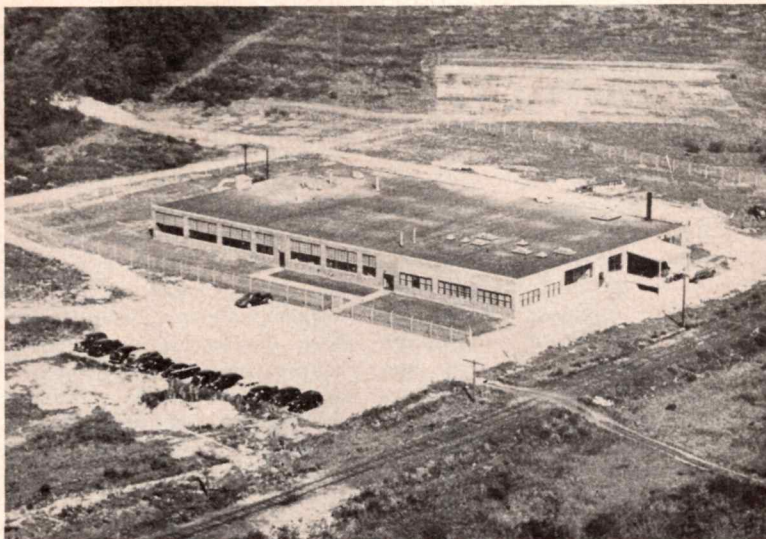
The challenges to which I refer are wrapped up largely in the one word "competition." Never, it seems, has competition on all levels been more pronounced than it is today. In our case, dozens of competitors have appeared to claim their share of business in our expanding field. Our customers, the airframe and engine companies, need no reminder regarding the competition that faces them in securing both commercial and government business.

Airline operators—scheduled and non-scheduled, overseas and domestic—need fewer lessons today than ever before in what competition has done to the job of getting the customer's dollar. Even the military people and international statesmen have their competition, and in a sense theirs is a more difficult burden to bear than ours because it is less tangible.

But there are certain compensations in all of this. Never were our Des Moines and San Diego plants more efficient; never were our people more eager and productive—and competition has made them so. Competition from the British in the field of turbine-driven airplanes has stimulated thought in America to an extent nothing else ever could or would. That, in my opinion, is a healthy state of affairs; developments always proceed fastest when the most brains and effort are put to work on them, and a friendly international rivalry will certainly put the turbine-driven airliner in 1955 ahead of where it would have been were it the interest of only a single nation.

Gone are the times when a man in the aircraft business could take a look at the Federal budget for the year and automatically compute his gross for the coming year from the "drippings" of those expenditures. 1950 and thereafter will be years of competition in the aircraft business, a condition my associates at Solar and I are glad to see maintained, regardless of the problems it may mean to us. This aspect has been, for decades, a cornerstone of our economic life.

May the best man win.



Rise in acceptance of precision casting as a solution to many design problems is attested by rapid growth of such facilities. Shown is new Microcast Division plant of Austenal Laboratories, Inc. at Dover, N. J.

"Military procurement will determine"

WILLIAM M. ALLEN
President, Boeing Airplane Co.

MILITARY procurement will be the principal factor determining the immediate future of the airplane manufacturing industry. The amount of activity in most plants will depend almost wholly on the Government's determination of the need for air power and the amount of public funds that may be expended for it. Because of extreme advances in performances, the cost of designing and developing new types is high and necessarily there is a considerable time lapse before they can be made available for use.

We naturally have a great deal of interest also in the commercial-transport field, but the production possibilities in that field in the near future are

not large. Domestic airlines are now well along with their post-war re-equipment programs, and dollar problems are hampering foreign sales. A period of development and testing remains before new jet-transport types will be marketable in large numbers.

This development has been retarded by the extraordinary business risks involved, including the high development cost, the lack of customers with money to buy, and the difficulties and uncertainties of certification under present CAA regulations. Whenever these present risks can be substantially reduced, by one means or another, the development and commercial use of jet transports appears inevitable.

"The gas turbine has come of age"

C. W. LaPIERRE
Manager, Aircraft Gas Turbine Div., General Electric Co.

AIRCRAFT gas turbines in use are numbered in the thousands. Ten years ago the only production aircraft application of gas-turbine components was in the turbosupercharger. Whereas it took 30 years to fully develop the steam turbine, the gas turbine, benefiting from this experience, has grown during the past decade to a point where the production of aircraft gas turbine horsepower per month far exceeds the production of steam turbine horsepower.

There is no better evidence that the gas turbine has come of age for military and commercial applications than the military budget for aircraft-pro-

pulsion systems, and the commercial developments in Canada and Great Britain. In this country, one axial-flow and two centrifugal turbojet engines have received CAA certification.

The outstanding results from aircraft gas turbines during the past 10 years have provided impetus for the design of locomotive, industrial, and central-station gas turbines. Already, some of these units have been in service operation for thousands of hours without overhaul. This experience is in turn being applied to the further improvement of aircraft components.

New designs are coming along to extend the range of application. Here

the work is proceeding to improve the efficiency, increase the output per unit of engine weight; and simultaneously, and most important of all, the results of our experience to date and our "know how" are being put to use to make the jet give the service life that one normally associates with the aircraft engine. There is nothing fundamental in the cycle or design that will not permit the gas turbine to exceed this service-life objective. Engine reproducibility and use of a minimum quantity of strategic and scarce materials in gas turbines are receiving as much attention as items affecting efficiency, output and service life.

The gas turbine is a new tool with

characteristics unlike those of previous aircraft powerplants. This new means of flight propulsion has introduced new problems, solutions for which are being found every day. In the laboratory, new instruments are being developed for this new tool to accelerate its development and to aid more adequately in insuring that the engine is dependable and airworthy. To produce this engine, new techniques, materials and instruments have been developed; new operating procedures and a new mode of handling are required to take advantage of the gas turbine's characteristics.

Where there exists a necessity, there is a way.

"Military program is the key"

T. CLAUDE RYAN

President, Ryan Aeronautical Co.

IN THE final analysis, the key to the success of all aircraft manufacturers in 1950 is related directly to the scope of the military aircraft program.

Although all the important studies which have been made by the President's Air Policy Commission and by a similar Congressional group still maintain the necessity of a 70-group Air Force—even during a period of settled world conditions—many who have fought hardest for this policy have come to accept the lower level advocated by the Administration. Thus, little expansion in total activity can be anticipated this year.

In general, there was a leveling-off of activity in the latter half of 1949 as compared with the earlier part of last year, and in our own and other companies it appears that the rate of activity at the close of 1949 will be maintained at about this level during 1950.

In our own company, we anticipate fairly stable operations in both our airplane and metal-products divisions. The market for personal-executive

planes, like the Ryan *Navion*, should be better than last year, when the market was hurt seriously at its normal best selling season by general concern over the prospect for business conditions. On the basis of present business forecasts, there appears to be good reason to believe there will be less apprehension this coming year, which should result in a somewhat better market for personal-business planes.

The 1950 fiscal year funds for military planes are now being placed; Ryan Airplane Division will benefit in both prime and sub-contractor work.

Our Metal Products Division continues as a major activity, with indications that the percentage of jet-components business will be increased during 1950 as this type of engine comes into every-widening use. With Ryan exhaust systems standard on most of the twin- and four-engine commercial and military transports, our volume of business for exhaust systems and allied accessories should continue high.

"Back-country cargoes"

M. STROUKOFF

President, Chase Aircraft Co., Inc.

WE IN THE aviation field in America must make substantial contributions toward the development of backward areas of the world by continuing our research and development programs to even greater achievement.

A large portion of this research must be devoted to the design of efficient cargo and personnel carrying transports, for their value in delivering bulk cargo and supplies speedily to normally inaccessible areas for further development of such areas; also for commercial aviation in times of peace and as a reserve for potential military requirements.

The success of our Air Force in supplying all the needs of Berlin over an arbitrary and cantankerous blockade demonstrated amply the potentials of air cargo. The development of this phase of aviation to date, while it has been noteworthy, leaves much to be accomplished in the foreseeable future.

Chase Aircraft was formed seven years ago principally to design and produce cargo-transport airplanes. Since its founding, five cargo aircraft have been flown and tested, and the sixth will fly early next spring. Ruggedness and simplicity without sacrifice of aerodynamic efficiency and performance have been designed into each *Avitrac*.

They were designed specifically for the transport of heavy cargo and bulky equipment into unprepared fields to which normal transportation is difficult or non-existent, or which may be inaccessible otherwise by reason of natural barriers. Military missions must include the supply by air of advanced combat positions, the evacuation of wounded and the air transport of paratroops and their equipment to their jumping areas.

We can't stop here; progress and development must continue for greater efficiency and economy and for larger, higher-speed transports. Chase currently has on its design boards the MS-9, a long-range, high-speed transport, capable of trans-ocean delivery of payloads much larger than yet attempted.

Air-transport development should be concentrated on the design of larger transport aircraft to operate efficiently from existing fields, rather than devoting equivalent design effort to the development of bigger, more-expensive airports made necessary by lack of airplane refinement.

"Transportation is the new lightplane market"

DWANE L. WALLACE

President, Cessna Aircraft Co.

THE personal-aviation industry made progress in 1949. The record indicates that during the past year the largest share of aircraft sold were in the four-place, or larger, category—indicating that aircraft sold today are being purchased for transportation and not for "airport hopping" and pilot training, which has been the big market in past years. This is the proper foundation on which the industry can grow, and we look forward with confidence to the years ahead and

to the growing acceptance of the private airplane as a means of travel.

Today's airplane provides an outstanding forward step in transportation and there is a great need to demonstrate in the safest and most effective manner how valuable this transportation is to business people and others who have traveling requirements. This, of course, will require a good, sound field sales organization and the cooperation of all those interested in private aviation.

"We are learning how to attack problems"

P. R. BASSETT

President, Sperry Gyroscope Co.

THE outstanding thing about aviation is that it provides constant challenge. There is never a status quo. Instead there are always new missions for aircraft to accomplish which keep designers at their drafting boards and scientists busy in their laboratories. Today, both civil and military aviation are calling for much to be done—new aircraft, new powerplants, new instruments, new controls.

In view of these continuous challenges, it is significant that there is emerging an intelligent methodology for meeting them. It is evident in the rise in stature of research and develop-

ment. Both military and civil aviation leaders realize the necessity for planned fundamental research and prototype development. They appreciate the great dividends that such a program pays in progress.

It is less than half a century since aviation became an industry. Now, at mid-century, it is an activity of sizable proportions and its further growth is inevitable. Its future promises to be a most productive one if research and development continue to receive emphasis. As someone has wisely said, "Vision is indispensable to progress."

"A race for more automatic controls"

VICTOR E. CARBONARA

Vice-President, Square D Co., Kollsman Instrument Div.

AVIATION, the favorite child of the 20th Century, has at this midpoint come to the crossroads. This is the day when, after its unique expansion, aviation must concern itself with supersonic speeds and unprecedented altitudes. Hence, in the field of instrumentation, the trend has been toward a greater number of instruments which are more complex and more exacting, and which cover wider ranges of speed, altitude and temperature.

Yet the increasing complexity of instruments must of necessity be related to the normal human limitations of the eyes and the brains of the men in the cockpit. Our records show that no added workload can be borne safely by the pilot.

This challenge can be met only by simplifying the path between man-made instruments and man. There-

fore, research and development is now turned toward designing instruments which not only indicate, but which also control. More and more, aviation instruments will stand as monitors of automatic controls, leaving the pilot as a supervisor who takes over only in an emergency.

The pursuit of the ever-increasing requirements is almost feverish. The path between instrument and man is the only thing that is being simplified: the rest is growing more complicated. Gone is the day when the instrument maker was just a super mechanic; the scientist has an important role there now, and a team has replaced the individual.

Such is the price of progress. We only can board the bus and sit down in comfort when the bus stops. So long as it keeps on running, so must we, or be left hopelessly behind.

"Better airframes and powerplants for defense"

JOHN K. NORTHROP

President, Northrop Aircraft, Inc.

THE year 1950 appears likely to be productive and busy for the aircraft industry. Most airframe manufacturers now have fairly sizable backlogs, and this healthy condition is being reflected in the manufacturing facilities which supply engines, accessories, equipment and parts for the major airframes.

Our current manufacturing level, however, is considerably lower than the schedule recommended by two fact-finding bodies, the President's Air Policy Commission and the Con-

gressional Aviation Policy Board, which evaluated U. S. defense needs in 1947. The people have indicated that they believe a strong and well-equipped air arm is essential to our peace and security.

It is unfortunate that we must, in the world today, constantly arm ourselves against aggression, but the President's disclosure of our plans in developing the awesome "H" bomb and his statement of our defense policy leave little doubt of the course which is necessary for America unless

our diplomats are successful in their aim at an assured peace.

Our military services have made judicious use of the funds available for air defense. In a relatively short time, we have come a long way in the development of high-performance aircraft and in the field of guided missiles. We feel that a program providing even more emphasis on the development of guided missiles would be a wise one. Pilotless weapons, which can be stock-piled against an emergency, are fast "winning friends and influencing people" toward the day when they can form the main backbone of the Air Force's offense and defense.

Increased speeds and ranges in aircraft today are due largely to two causes: first, the constant aerodynamic refinement of the airframe; and second, the constant improvement of powerplants. This company long has felt that a great promise in the latter field lies in the development of the turboprop engine. In the past year, our own tests, as well as the experience of other manufacturers, have borne out this belief, and we are now able to produce a practical turboprop engine delivering its power to a shaft and highly-efficient propeller instead of in the form of pure jet thrust.

This new and efficient propeller-driving gas turbine, which offers great advantages in range at relatively high speed, is likely to come still further into use during 1950, and will make possible a combination of high speed and long range hitherto considered impossible.

"The novelty is over"

C. J. REESE

President, Continental Motors Corp.

FACTORS bearing upon the sales of personal, family and executive type aircraft in 1950 seem to have undergone little change in the past 60 days. As of Jan. 1, prospects for an upturn appeared fairly good. How much of an upturn it was and is anybody's guess.

A degree of optimism certainly is justified by the way in which the light-plane gains wider and wider acceptance on the basis of its ability to pay its own way. In this respect, it's about where the automobile was 45 years ago. When novelty gave way to utility, automobiles were here to stay. The airplane may not multiply as fast as the automobile, but once its utility is established the trend should be steadily upward.

Among specific fields where utility is being proved is that of local airlines using single-engined planes. It is still

too early to predict 1950 progress in this direction, but public patronage of the few lines already flying is encouraging. So is the wider use of utility-type planes by corporate owners, and the fact that some such owners have switched to economical lightplanes after starting out with liner types.

Farmers and ranchers, too, are finding more and more jobs for the plane. Current research to develop the ideal type of ship for farm use should enlarge this market eventually, though hardly in the coming year.

It is hard to say how much benefit the industry will derive in 1950 from the two recent acts of Congress relating to its problems. But the Post-

master General is now authorized to enter into air-mail contracts with lines using single-engined planes on Star routes, and revenue from this source is already doing its part for at least one pioneer local line. Rules under which GI's can qualify for flight training have been loosened, but, after overestimating the effects of the GI-training program immediately after the war, few care to predict the results of this liberalization.

The outlook is certainly brighter than for some time past. And I still think it significant that today's optimism is based on something solid—the steadily-increasing utility of the modern plane.

"Start of the jet-transportation age"

CARL B. SQUIER

Vice-President, Lockheed Aircraft Corp.

TRYING to predict the course of aviation for the year 1950 is almost as difficult as attempting to predict its course for the entire fifty-year period we are just entering.

There can be no doubt that tremendous events are impending, perhaps coming to fruition within this next calendar year. Of greatest importance is the imminent advent of commercial jet transportation looming over the near horizon. Already a reality overseas, perhaps 1950 will see the announcement of American designs of advanced jet transports for service within the next four or five years.

Practical military aircraft with speeds well into the sonic range also could make their appearance this year. Military units already are equipped with fighters that crowd close to Mach 1, and research aircraft are flying well in excess of that rapidly shrinking wall. So the advent of Mach 1-plus fighters should not be far away.

In the immediate field of commercial passenger transportation; another great change is upon us—the swing to cheap mass transportation, forerunner of the day when practically all long-haul passenger travel will move by air.

First introduced by the "non-sked" airlines, at the close of the war, coach travel has now been taken up by the regular scheduled airlines (with varying degrees of enthusiasm, I must add). Many of us in aviation feel that this experiment in mass transportation can become the dominant factor in all commercial transportation, perhaps within the coming year.

As for the state of the aircraft industry itself, 1950 should be an active, reasonably profitable year with most of the manufacturers working on well-

established programs, both military and commercial, at a level of activity sufficient to keep the industry healthy and progressive.

Many of us wonder, however, just how far this healthy state of affairs extends beyond 1950. To keep expensible and progressive, as it must be to meet the demands of national security in this supersonic age, the aircraft industry must stay active on the assembly lines as well as in the engineering laboratories. As of today, it is difficult to see how we are going to maintain this activity very far beyond the start of 1951.

Certainly things are moving faster than ever before in aviation. Jet propulsion has speeded up not only our aircraft but our thinking, our planning and our operations generally.

"New fuel for new powerplants"

JOSEPH S. HARRIS

Manager, Aviation Dept., Shell Oil Co., Inc.

IN TEN short years, there has been a revolution in aircraft powerplants. In February 1940, the reciprocating engine was supreme. Outside of a few reference in the patent literature, little was known of jet propulsion. But today, nearly every new military aircraft is powered by the turbojet, and the application of jets to commercial aircraft is already under way, with pioneer work being done in England by the deHavilland *Comet* and the Avro *Tudor 8*, and in Canada by the Avro *Jetliner*. Another development, planned for a more advantageous combination of speed and range, is the turboprop, which has reached the point where it promises to be a serious competitor of the re-

ciprocating engine at speeds of about 400 mph.

For high-speed aircraft, both military and commercial, there is little doubt that the gas turbine will be the answer. And the question now uppermost in everyone's mind is: How soon will the gas turbine be in general use on the commercial airlines?

A survey of all the factors involved indicates that we cannot expect jet airlines to be introduced in this country before 1955, and it is highly improbable that they will come into general use before 1960. Some existing aircraft soon will be modified for the turboprop, but the move probably will not be extensive, because we have relatively little experience with this type

"Cross-wind wheel receives wide acceptance"

R. W. RICHARDSON

*Manager, Aviation Products Div.
Goodyear Tire & Rubber Co., Inc.*

WITH the Government, aircraft manufacturers, airlines and distributors ranking in order of customer sales in the Aviation Products Division, production volume will revolve around airplane tires and tubes, wheels, brakes, fuel cells and miscellaneous rubber items.

The continued development of the Cross-Wind wheel, which now has been adopted by manufacturers and two major airlines, also will prove a growing factor in our over-all sales program. The Cross-Wind wheel has won wide acceptance and now is in the practical application stage.

Goodyear's primary business is in the transportation field and the company's participation in aviation dates back in 1909 when P. W. Litchfield started development of the pneumatic airplane tire. The company's research and development in aeronautics has been continuous since that time and Goodyear has made numerous contributions to aviation progress.

Current development work, both in behalf of the Government and industry, will have as stimulating an effect upon the future of aviation as was Goodyear's development of the *Air-wheel* in 1927 and the hydraulic brake for airplanes in 1933.

of engine as compared with turbojets.

In so far as the petroleum industry is concerned, every effort is being made to have available the fuels that will be needed by jet aircraft and to provide these fuels in sufficient quantities. Turbojet aircraft will consume about three times as much fuel as conventional aircraft, and the petroleum industry will have to design production, transportation and storage facilities to handle these larger volumes. The problem of maintaining the quantity of fuels and at the same time producing enough to meet a rapidly growing demand also is being studied carefully.

We must not conclude, however, that the reciprocating engine is on the way out. For the next several years it will still be the mainstay of aviation. The fuel requirements for this type of engine will continue to increase, and requirements for higher-octane fuels

may come as certain engines are further refined.

Every effort is being made by the petroleum industry to improve the performance of both aviation gasoline and jet fuels. To this end, Shell is flying an XB-26 research plane equipped with two Pratt & Whitney R-2800 engines and a General Electric J-31 jet engine. Special instrumentation has been installed for study of the fuels and lubricants in each type of engine. In short, even as a new line of growth in aircraft powerplants has appeared, the old line continues, and the XB-26 is meant to serve them both.

From the beginnings of heavier-than-air flight, the aviation and petroleum industries have worked well together and turned in a remarkable record. Now, at the mid-century, it seems highly probable that the story will be told again, with still more spectacular results, in the years to come.

"A time to educate the public"

W. T. PIPER

President, Piper Aircraft Corp.

THERE is nearly as much difference between small planes and large ones as there is between a rowboat and a battleship. My experience has been entirely with those resembling the rowboat and, for that reason, I am not qualified to discuss aviation except in connection with this type of aircraft.

During the war, the aviation industry had more free publicity than any other industry ever received and people with their lack of familiarity with the plane greatly overestimated the number of planes that would be purchased. The airplane is essentially a machine for long trips which most of us make very infrequently. The automobile, on the other hand, is a machine especially valuable for short trips. Its great popularity is due to the fact that formerly we all made short trips by walking, trips which now can be made more easily by using an automobile.

To compare the growth of the two industries and to criticize the aircraft, therefore, is very unfair, because the

airplane has not equalled the automobile in growth. As I have said before, the greatest need of aviation is to educate the public so that people will know how and when, and by whom, an airplane can be used most advantageously.

New, low-priced four-place models will practically revolutionize the industry. The cost is so near that of the two-passenger plane that, from now on, the two-passenger planes will be built largely for special jobs and the four-passenger plane will be the most popular.

As we learn to use the planes properly, it is possible to make many trips with them more quickly, more comfortably and with less cash outlay than the same trip can be made by railroad coach or by bus. This opens up a tremendous field of activity for the airplane. It is necessary for us in the business to educate the public along these lines, and I feel confident that the lightplane industry will have a steady and satisfactory growth.

gines to meet his most exacting requirements. Rate of development in turbojet engines has been so rapid that, where the importance of speed overshadows the range requirement, he may choose among several turbojet engine models. Each will give him great power per pound of weight, with the assurance of good engine dependability.

For his longer-range requirements, the designer now can specify turboprop engines covering a range from a single-unit 2750-hp engine to a multiple of 5500-hp units. These Allison turboprop engines, developing more than two hp per pound of weight, have an economy of fuel consumption comparable with that of our best present-day reciprocating engines.

With these same engines, it is possible also to short-cut the long time and huge cost factor in the design and development of new-type aircraft. With very minor modifications to the aircraft, the turboprops can be used as replacements for reciprocating engines in certain types of existing aircraft—such as present commercial transport types. By doubling the power-to-weight ratio of the present engine installations, these turboprops will permit greater payload with no sacrifice in range. And, instead of speeds in the order of 275 to 300 mph, these same planes could fly 25 to 100 mph faster than with the older engines.

By virtue of this greatly improved performance, these modified airplanes would represent the equivalent of new aircraft types. And yet, the time and expense involved would be small. Thus the taxpayer, too, would get some return from the investment of the Military Services in advanced powerplant design. This investment, plus the teamwork between the Services and the aircraft engine industry, represent the positive assurance that this country never will have to go outside its own shores for the latest and the best in aircraft engines of any type.

"Firmer foundation"

R. F. GAGG

President, Air Associates, Inc.

THE volume of business done by Air Associates is a composite related to activity in all sectors of aviation, and current prospects justify modest optimism for the near future.

The market for aircraft products manufactured by us depends on manufacturers of military and transport aircraft. The military backlog and some new airline orders insure a busy year for big airframe builders, and

(Continued on page 130)

"Passing of high-powered reciprocating engines"

R. M. HAZEN

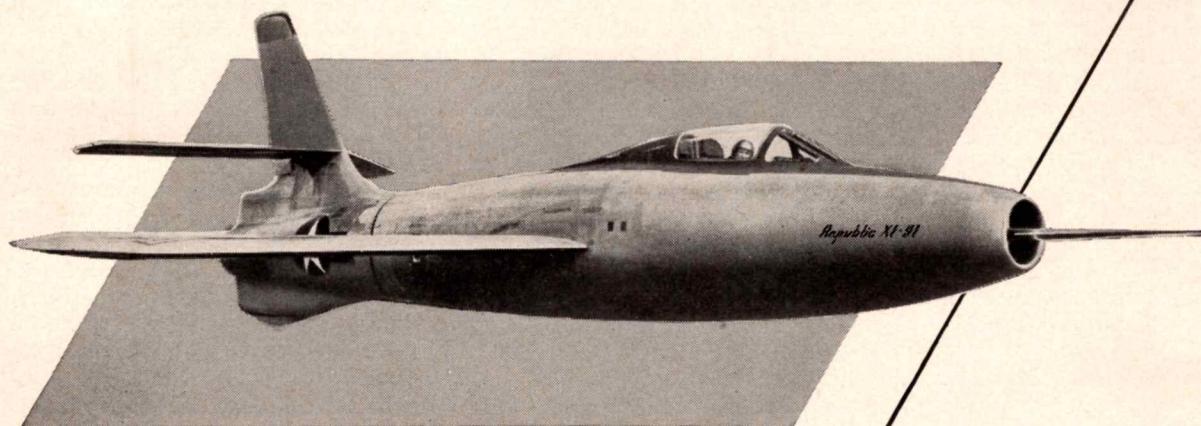
Director of Engineering, Allison Div., General Motors Corp.

FROM the standpoint of engine power, the aircraft industry today faces a future in which there are no known limits. The standards and limits by which engineers judged future potentials in reciprocating engines have been thrust into the discard by the spectacular rate of development of gas-turbine engines. Today the high-

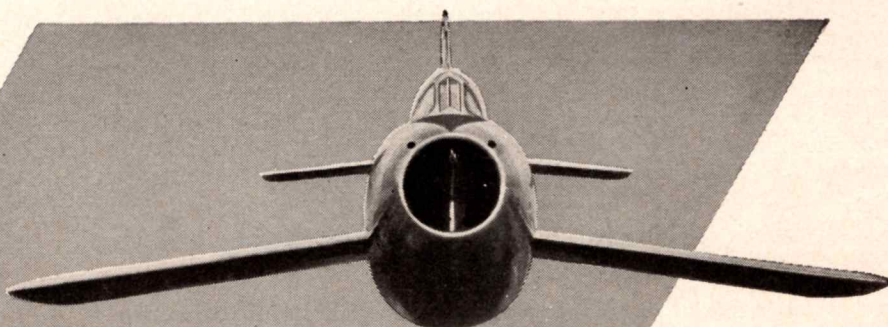
powered reciprocating engine is in the twilight zone of a long and useful career. Its complete replacement in the foreseeable future is an inevitable conclusion.

For aircraft in the subsonic- and transonic-speed ranges, the designer at this time need turn only to a selection between turbojet and turboprop en-

THIS IS THE XF-91



Made by the makers of the mighty Thunderbolt . . . which set enviable records in the hands of Air Force pilots during World War Two . . . and later, builders of the F-84E Thunderjet now being manufactured in quantity for the Air Force . . . Republic is justifiably proud of the XF-91 presently undergoing flight tests at the Muroc Air Force Base in California. ¶ Conceived and produced to perform as a high speed . . . high altitude interceptor . . . with both turbo jet and rocket power . . . the final acceptance specifications of this great ship will, we are confident, prove to be one more vital weapon in Democracy's arsenal. . . . Republic Aviation Corporation, Farmingdale, Long Island, New York



REPUBLIC  **AVIATION**



Makers of the Mighty Thunderbolt • Thunderjet • XR-12 • XF-91

AERO DIGEST'S 1950 CHART OF U. S. WARPLANES*

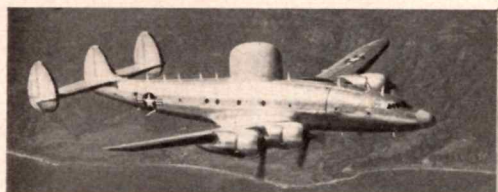
	Manufacturer	Name	Air Force	Navy	Dimensions			Weights			Engine			Performance					REMARKS	
					Span ft	Length ft	Height ft	Gross Wt lbs	Empty Wt lbs	Passenger and Crew	Builder	Model	Horsepower (max)	Maximum Speed mph	Cruising Speed mph	Service Ceiling ft	Range or Radius miles	Fuel Capacity gals		
1	AERONCA		L-16A		35	21.5	7	1320	810	2	CONTINENTAL	C85-12K1	85	100	90	R	270	R		1
2	BEECH	Mentor	T-34		32.8	25.85	9.6	2650	1901	2	CONTINENTAL	E-185-B	205	180	165	17,200	82.5	50	Incorporates controls and features of combat craft for training	2
3	BELL	Model 48	YH-12B		47.5	39.7	11.5	6286	4450	5	1 P&W	R-1340	600	115	90	15,000	300	200		3
4	BELL	Model 54	XH-15		37.33	43.75	9.2	2700	2000	2	CONTINENTAL or FRANKLIN	XO-470-9 XO-425-7	240 245	100	R	R	100	50		4
5	BOEING	Superfortress	B-50D		141.2	99	32.7	164,500		11	4 P&W	R-4360	3500	400+	300+	35,000+	Radius 3000+	R	Single point refueling system	5
6	BOEING	Superfortress	RB-50B		141.2	99	32.7	140,000		6-13	4 P&W	R-4360	3500	400	300+	40,000	Radius 3000+	R	Includes new cameras, improved radar, aerial refueling, weather-recording instruments	6
7	BOEING	Stratofreighter	C-97A		141.2	110.3	38.25	148,000		3-5	4 P&W	R-4360	3500	350	300+	30,000+	4000+	7790	Carries 52,000 lbs cargo, 134 fully equipped troops, or 32 litter patients and attendants	7
8	BOEING	Liaison Scout	L-15A		40	26.25	8.7	2050	1509	2	LYCOMING	O-290	125	112	180	16,400	252	21	All metal, may be disassembled for truck transport	8
9	CHANCEVOUGHT	Corsair Night Fighter		F4U-5N	41	34	13	13,300	10,418	1	1 P&W	R-2800 -32W	2100	452	180	40,000	1120	384	Used as transition to jet fighters	9
10	CHASE	Avitruc	C-122C		95.7	61.7	24.7	40,000	19,000	2	2 WRIGHT	R-1820 -101	1425	240	200	29,100	1070	1300	Troop and cargo transport	10
11	CHASE	Avitruc	XC-123		110	77	32.7	54,000	25,000	2	2 P&W	R-2800	2400	245	215	29,000	1160	1340	Performance figures for 42,000 lbs gross weight	11
12	CONVAIR	Long-Range Bomber	B-36D		230	162	46.75	326,000		15	6 P&W and 4 GE	R-4360-4 J47	3500, 5000	400+	300+	40,000+	10,000	21,000	Four jet engines reduce takeoff run and increase speed when necessary	12
13	CONVAIR	Transport	C-99		230	183	53	265,000			6 P&W	R-4360	3500	R	R	R	8100	R	Carries cargo load of 100,000 lbs or 400 troops	13
14	CONVAIR	Liaison	L-13		40.5	31.7	8.42	2900	2070	1	1 FRANKLIN	O-425-9	245	116	92	15,000	750	112.5	Used also for rescue service	14
15	CONVAIR	Navigator Trainer	T-29A		91.75	74.7	27	40,500	29,000	3	2 P&W	R-2800-9T	2400	308	220	26,100	1010	1000	A flying navigation classroom for 14 students	15
16	DOUGLAS		C-124A		173.3	127.1	48.2	175,000	125,000	9-15	4 P&W	R-4360-4	3500	R	R	R	R	R	Heavy-duty strategic transport	16
17	DOUGLAS	Skyraider		AD-4	50	38.8	15.6	16,065	10,519	1	WRIGHT	R-3350 -26W		R	R	R	R	R	Navy attack bomber; carries rockets, bombs, or torpedoes	17
18	FAIRCHILD	Packet	C-119	R4Q	109.3	85.4	26.5	71,800	38,329	5	2 P&W	R-4360 -20W	3500	266	R	21,200	2925	2798	Troop and cargo carrier up to 10 tons	18
19	FAIRCHILD	Trainer	T-31	NQ-1	41.3	27.9	9	3724	2786	2	LYCOMING	R-680-12	280	174	148	15,750		80	Winner of Bufer's trainer design competition	19
20	GRUMMAN	Guardian	AF-1S AF-23		R	R	R	R	R	2	1 P&W	R-2800	2100	R	R	R	R	R	Carrier-based anti-submarine plane	20
21	GRUMMAN	Albatross	SA-16A	UF-1	80	61.3	24.5	R	R	6	2 WRIGHT	R-4820-76	1425	270	215	R	1400	R	Air force rescue, Navy utility plane; 16 passengers	21
22	LOCKHEED	Neptune		P2V-3	100	78.2	28.1	158,000	32,910	7	2 WRIGHT	R-3350	2500	300	170+	27,200	3500	2821	Modification for depth charges	22
23	LOCKHEED	Constellation		PO-1W	123	95.3	23	R	R	R	4 WRIGHT	C-18-B1	2500	R	R	R	R	R	Equipped with Radar Early Warning devices for long-range operations and enemy interception	23
24	MARTIN	Mercator		XP4M-1	114	84	26.8	80,000			2 P&W or 2 GE-ALLISON	R-4360 783A-4	3500, 4000	350+	200	R	3000	R	Long-range anti-submarine search and attack plane	24
25	MARTIN			XP5M-1	R	R	R	R	R	7	2 WRIGHT	R-3350	2700	200+	R	R	R	R	Patrol plane designed to succeed Martin Mariner	25
26	MARTIN	Mauler		AM-1	50.1	41.5	16.9	22,166	14,000	1	1 P&W	R-4360	3000	350+	280+	25,000+	1700+	900+	Recently took off with 10,489 lbs armament	26
27	NORTH AMERICAN	Advanced Trainer	T-28A		40.1	32	12.66	6759	5111	2	1 WRIGHT	R-1300-1	800	288	190	29,800	1008	125	Winner of Advanced Trainer Competition	27
28	NORTH AMERICAN	Texan	T-6G		42	29.5	10.8	6000	4271	2	1 P&W	R-1340 -AN-1	600	212	146	24,750	1000	145	T-6 trainer; factory re-manufactured and modernized	28
29	NORTH AMERICAN			AJ-1	R	R	R	about 55,000	R	3	2 P&W 1 GE-ALLISON	R-2800 J35	2100, 4000	R	R	R	R	R	Navy's first piston-engine and jet attack bomber	29
30	NORTHROP	Raider	C-125		86.5	67.1	23.2	38,000	26,690	2	3 WRIGHT	R-480-99	1425	201	169	15,200	2080	R	Arctic rescue and light assault transport	30
31	PIASECKI	Rescuer	HRR-1		41	48	12.5	6900	5000	10	P&W	R-1340	600	120	85	12,000	300	100	Military transport	31
32	PIASECKI	Rescuer	HRR-2		41	54	14.8	6978	5054	10	P&W	R-1340 -AN-1	600	105	85	11,000	300	100	Military transport	32
33	PIASECKI	Retriever		HUR-1	35	31.6	12.5	5355	3966	5	CONTINENTAL	R-975-34	500	130	100	12,000	400	100	Navy transport for rescue; formerly ATR-1	33
34	PIASECKI	Transporter	XH-16	XH-16	R	R	R	R	R	R	R	R	R	R	R	R	R	R	Joint project of USAF and USN. Largest ever built with greatest useful load and range	34
35	RYAN	Navion	L-17B		33.4	27.3	8.5	2750	1838	4	CONTINENTAL	E-185-B	185	157	150	16,600	500	60.5	Liaison plane for Army and National Guard field forces	35
36	SIKORSKY	Model S-51	H-5H	HQ35-1	49	57.7	12.9	5500	3805	4	P&W	R-985-B4	450	103	85	5000	235	100	All-metal rotor blades permit 200-lb gross weight increase with same performance	36
37	SIKORSKY	Model S-52-2	H-19A		35	39	8.7	2600	1650	4	FRANKLIN	6V-245 -B16F	245	118	92	4800	415	62	800-mile range with auxiliary fuel	37
38	SIKORSKY	Model S-55	H-19		53	41.7	14.7	6800	4200	12	1 P&W	R-1340	600	110	86	5500	470	190	1000-mile range with auxiliary fuel. Used for rescue (8 litters)	38
39	TEMCO	Buckaroo	T-35		29.3	21.7	6.3	1900	1280	2	CONTINENTAL	C45-12H	145	145	135	14,000	470	28.5	All-purpose trainer for Air Force	39

R: Restricted

¹Pounds of thrust

*Chart includes piston-engine powered, propeller-driven aircraft only; comprehensive descriptions and illustrations of all U. S. jet-powered aircraft appear in the Jet Aircraft section, beginning on page 53. Complete specifications and pictures of military transports appear in the Transport Aircraft section, beginning on page 67. Complete specifications and pictures of military helicopters appear in the Rotary-Wing Aircraft section, beginning on page 84.

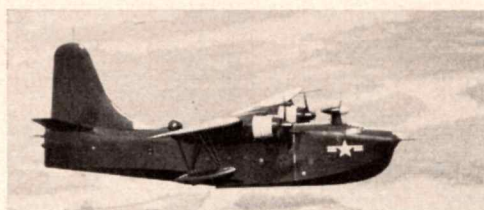
PLANES *of the* AMERICAN UNIFIED COMMAND



LOCKHEED PO-1W CONSTELLATION



GRUMMAN SA-16A ALBATROSS



MARTIN XP5M-1



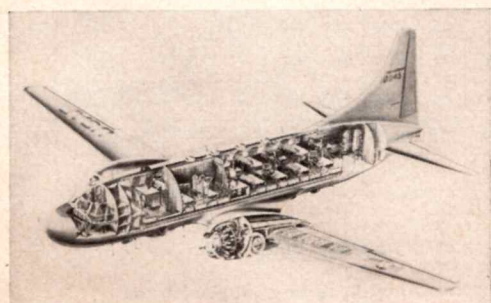
BEECHCRAFT T-34 MENTOR



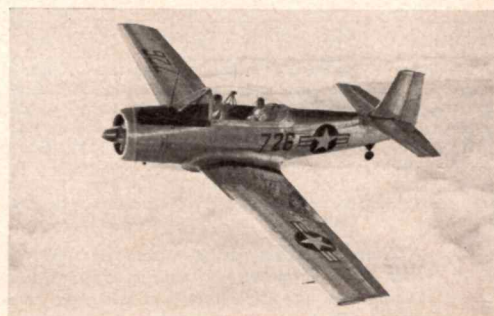
CHANCE VUGHT F4U-5 CORSAIR



RYAN L-17B NAVION



CONVAIR T-29 NAVIGATION TRAINER



FAIRCHILD T-31 (NQ-1) TRAINER

GRUMMAN AF-15
GUARDIAN



CONVAIR C-99 TRANSPORT

NORTH AMERICAN
T-28 TRAINER



DOUGLAS AD-1
SKYRAIDER



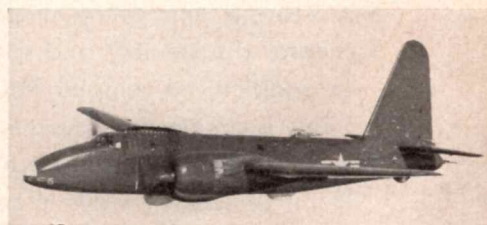
BOEING B-50B SUPERFORTRESS



TEMCO T-35
BUCKAROO

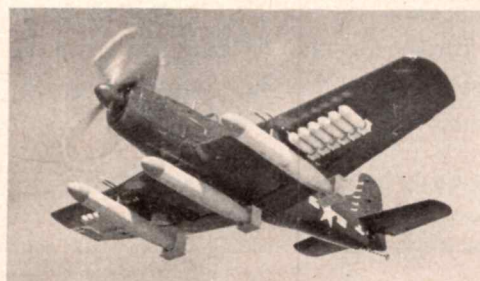


CONVAIR B-36D
INTERCONTINENTAL BOMBER



LOCKHEED
P2V-3 NEPTUNE

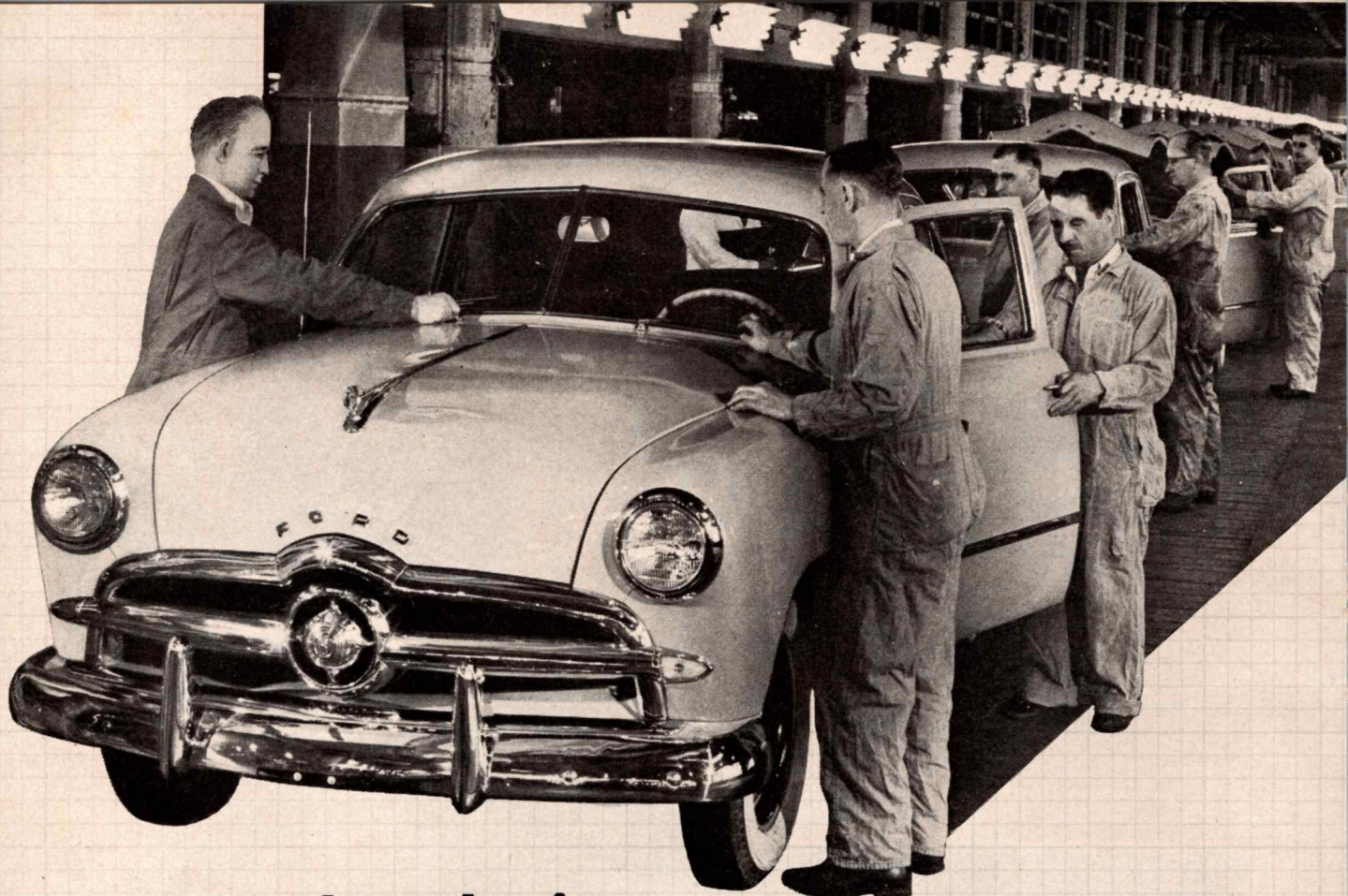
BOEING XL-15 SCOUT



MARTIN AM-1
MAULER

CONVAIR L-13
SENTINEL





to speed production

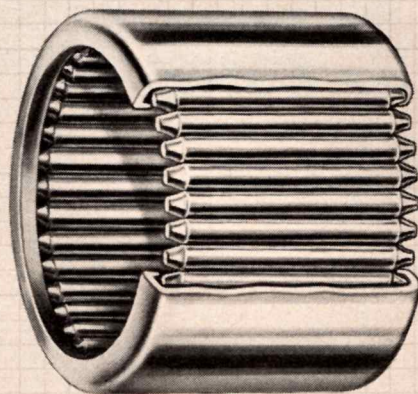
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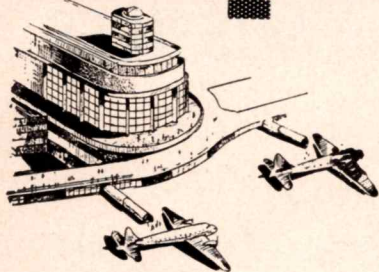
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Airports and Airways



Flares on Airports

JEROME LEDERER

Director, Flight Safety Foundation, Inc.

Federal Airport Act

THE Fourth Annual Report of the Federal Airport Act, prepared by the CAA for submission to Congress, covers all phases of work done under the Federal Airport Program through the fiscal year ended June 30, 1949.

Under this Act, annual appropriations amounting to a total of \$520,000,000 are authorized to be made by the CAA Administrator over a period of seven fiscal years. The maximum appropriation allowed for one fiscal year is not to exceed \$100,000,000 and should remain until June 30, 1953, unless sooner expended.

Since the passage of the Act, local public agencies have filed requests with the CAA for Federal Air totaling \$333,000,000 for the construction and development of airports. Congressional authority is required before undertaking any projects for the development of Class 4 and larger airports.

During the three years under the Federal Airport Program, the total allocations of all projects amounted to \$110,412,500, plus \$7,087,500 for administrative purposes. Of this sum, \$3,815,500 was for projects in Alaska, Hawaii and Puerto Rico; \$106,597,000 was for projects in the continental U. S.

The largest amount, \$5,398,486 was allocated to Texas, with New York, California, Pennsylvania and Illinois receiving the next sizeable. All States and the District of Columbia were represented in the program.

As of June 30, 1949, the program listed 965 airports, 690 of which were scheduled for development, while 275 were listed as new. Federal funds were matched with \$109,178,105 in local and State appropriations. There have been 12 airports programmed in the Territories. Of the 953 included in continental U.S., 281 were Class 1 airports; 231 Class 2; 197, Class 3; and 244, Class 4 and larger airports.

Of the 1322 projects listed 829 grant offers have been authorized, and 765 of these have been accepted, including 686 either under construction or completed.

The formulation of a National Airport Plan is being carried out, studies being made to determine criteria and standards of community needs, measuring the aeronautical potential of the communities and translating that into airport requirements. Publications showing the results of these studies include booklets on "The Economic Character of Communities," "Airline Passengers," "Air Cargo," "Airport Facilities" and others.

SEVERAL interesting safety items were mentioned during a recent Airport Managers Conference called by the CAA in the first region.

Emergency Flares — Crash Trucks.—When an accident occurs the control tower and crash truck shoot off flares as a warning to all aircraft in the vicinity that an accident has happened and to guide themselves accordingly.

Construction Flares.—Kerosene-type flares for marking construction work on airports are dangerous when placed in the vicinity of refueling operations. Contractors, ignorant of this danger, may inadvertently use kerosene flares. Portable flashing electric lights should be used. National Fire Protection Association Bulletin No. 34 (1948) describes an accident that supports this warning:

"The cause of the fire indicated some definite carelessness on the part of the truck operator. At the time of the incident, new telephone work was in progress at the airport, which necessitated digging trenches. One of these excavations was directly in front of the gasoline-loading platform and flare pots, plus two oil lanterns, had been set up and lighted to mark two piles of ground. Then the truck was backed in, the pots and lanterns were less than 18 in from the front wheel hubs. To set the fire stage further, the regular tractor for the trailer had been removed for repairs and the spare was considerably lower than the one it replaced, which resulted in the rear end of the tank being about 20 in higher than the front end.

"At 2230 hours, the truck tank was being filled through the rear tank compartment. Covers to all compartments had been raised and were wide open. After a considerable period, the operator's attention was attracted to the front of the tank and he observed that gasoline was overflowing from the front compartment. Obviously, the operator had not given thought to the difference in level of the front and rear compartments. The overflowing gasoline vaporized and ignited the flares.

"There is some discussion whether the prop-wash from an aircraft warming-up on the ramp nearby was responsible for the actual vapor ignition at the flares or whether the vapor concentration was caused by natural air currents. (Normal wind conditions were slightly favorable—velocity: 7 mph—to blowing vapors away from the oil lanterns which a prop wash conceivably would have nullified.) Regardless of the manner in which the vapors were brought in contact with the exposed flame, the very proximity of such an ignition source in the hazardous area should have been recognized by the truck operator of supervisory personnel."

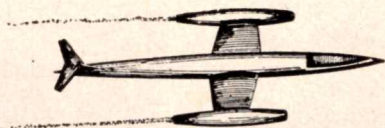
Marking Snow Hazards.—When an airport is covered with snow, a brilliant, red-colored powder produced by George Mann & Co., Inc., Providence, R. I., called *Sno-mark*, can be sprinkled over the snow to mark the proper path for aircraft to follow. It has been unusually successful in the New England area. It outlines runways, marks snowbanks, distinguishes concealed hazards or closed areas, forms no slush or ice.

Garbage Dumps.—Garbage dumps can affect the safety of aircraft seriously if these dumps are located near airports, because they attract sea gulls and other birds. Birds have been known to go through even the bird-proof windshields and incapacitate the pilots. They also get caught in induction systems, between cylinders and elsewhere on aircraft, creating additional hazards.

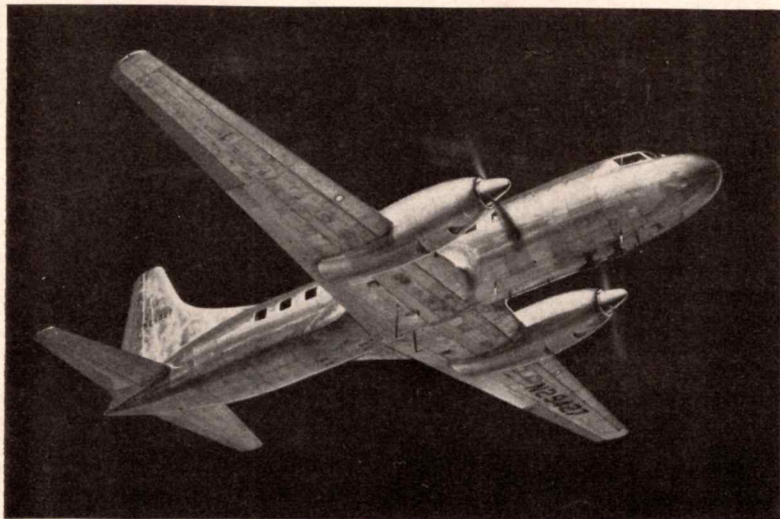
Air-Marking Program

THE 140 air-marker project of the Alabama Dept. of Aeronautics has been completed. Twenty-five old markers are being corrected. As of Jan. 1, 1950, Alabama had more than 500 serviceable ones of standard type.

Winter weather has temporarily halted the air-marking program in Wisconsin, with 555 markers completed and 65 to be finished this spring. There are now approximately 900 towns, cities and villages in Wisconsin that are air marked.



REACTION-POWERED PLANES AND MISSILES



Sketch of the "Turboliner"—a production model "Convair-Liner" (cargo version) which will be fitted with Allison T38 turboprop powerplants and Aero products propellers. Transport will be flown over regular airline-cargo schedules to acquire operational data which will be shared with airlines and aircraft mfrs.

Allison Does Something About It

THE Allison Division of General Motors Corp., producer of more gas-turbine aircraft engines than any other manufacturer in the world, has initiated a move which may well lead to a progressive changeover from piston engine-powered to jet-powered transports throughout this country and in many other nations as well.

Allison has ordered a production model *Convair-Liner* (cargo version) from Consolidated Vultee, to be fitted immediately with a pair of 2750-hp Allison T38 turboprop engines, faired into the nacelles, instead of the normal Pratt & Whitney R-2800's. Only minor nacelle modifications are required; these will be made at the Convair plant and preliminary flight testing will be done at San Diego.

Following that, Allison will bring the *Turboliner* to Indianapolis for extensive flight-test evaluation and to obtain operational data on the reliability of turbine-powered transports. Subsequently, it will be used in demonstrations to other aircraft manufacturers, the military air services and airlines. It is expected that the turboprop plane will be loaned to airlines for regular cargo runs to afford an opportunity for evaluation of its performance when "under fire" on scheduled operations.

All data obtained will be shared with interested aircraft manufacturers and airline industries.

The *Convair-Liner* was chosen because Allison officials wanted a transport in everyday use which could be converted to turboprop power in a short time at minimum cost. Convair officials state that more than 150 Model 240's are in service over routes of 12 airlines throughout the world—and that they have been flown more than one billion passenger-miles without a fatality. These factors should afford a fine opportunity for a relatively economical comparison between reciprocating and turboprop engines in commercial operations.

The Allison T38 turboprop develops 2750 hp; weighs 1225 lbs—less than one-half hp per lb and probably
(Continued on page 127)

Rockets and Ramjets at Princeton

ONE of the projects of the Princeton University Department of Aeronautical Engineering is research into the ducted rocket, utilizing the rocket as the primary jet and mixing its hot exhaust gases with a secondary stream of air. The Laboratory pro-

Economics of the "Comet"

DE HAVILLAND has announced the results of studies concerning the comparative earning capacity of the *Comet*, its jet-powered transport. The company claims that earlier predictions are borne out, namely, that the greater speed of the jet transport more than makes up for the cost of higher fuel consumption of its powerplants.

In comparison with the latest airliners in its class in service, de Havilland claims the *Comet* to be approximately 20% cheaper per ton-mile of payload and to produce 50% more ton-miles in a year.

The 20% figure is based upon flights of 1500 to 2000 miles and a utilization of 3000 hours per year. The SBAC method of cost finding was employed. The formula does not provide for assessment of maintenance costs on jet engines, so de Havilland established these figures in the light of their extensive knowledge and experience with turbojets—which yielded a cost per hour slightly less than that of reciprocating engines. The purchase price of the *Comet* was put at \$1,260,000; there is no propeller maintenance.

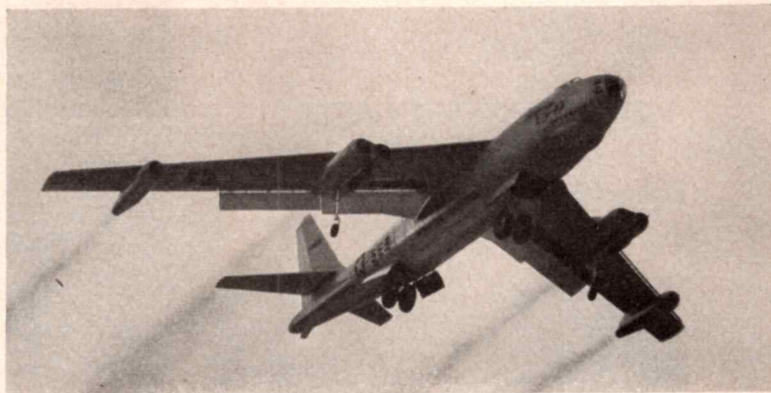
The study makes allowance for stacking and landing delays and for diversion to alternate airports. Investigations into shorter trip lengths is said to bear out early assumptions that the *Comet* can be economical on flights of 1000 miles and less.

De Havilland points out that these cost calculations are based upon the performance of the *Comet* as it is today. More favorable figures are expected as developments in work, on both powerplants and aircraft, are incorporated.

duced a special rocket of 50-lbs thrust to study operations over a wide range of fuel-oxidizer ratios for flexibility, economy and replaceability. It uses liquid oxygen as the oxidizer; ethyl alcohol, gasoline and diesel oil have
(Continued on page 126)

UNITED STATES JET AIRCRAFT

*Specifications on current
British gas turbines appeared
in AERO DIGEST November, 1949*

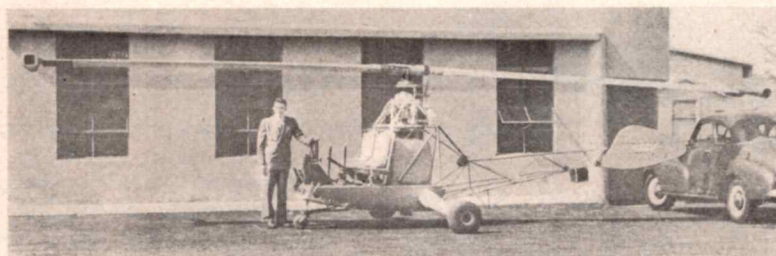


BOEING AIRPLANE CO.

Medium Bomber, USAF XB-47 Stratojet

Maximum speed, over 600 mph; service ceiling, over 35,000 ft; span, 116 ft; length, 107 ft 5.6 in; gross weight, over 125,000 lbs; six J35 or J47 turbojets mounted as external pods underneath wing; three crew; high-wing, all-metal; bicycle landing gear employs Goodrich brakes.

Two prototype XB-47's built in Seattle plant. One is now modified to incorporate features of production B-47A, including installation of six J47 turbojets of 5000-lbs normal thrust; first installation was J35 engines producing 4000-lbs thrust. Prototype made transcontinental flight of 2289 mi in 3 hrs, 46 min, claimed to be an all-type distance and speed record. Plane was equipped with J35 powerplants. B-47A is in production at Wichita.



AMERICAN HELICOPTER CO., INC.

Helicopter, Model XA-5

(USAF experimental)

Maximum speed, 80 mph; cruising 70 mph; rotor diameter, 33 ft; empty weight, 900 lbs; gross weight, 1500 lbs; two American Helicopter pulse-jet AJ 8.75 engines, located one on

each rotor blade tip; fuel capacity, 50 gals; disc loading, 1.75 lb/sq ft; fabric-covered rudder; tricycle landing gear; 24-v electrical system.

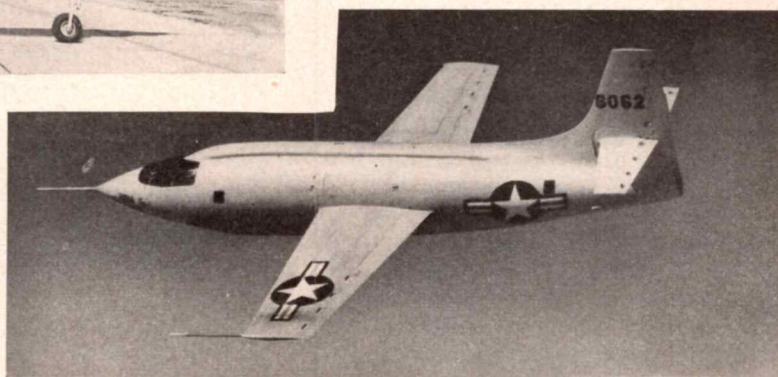


CHANCE VOUGHT AIRCRAFT

Fighter, Navy F7U-1 Cutlass

Cruising speed, more than 600 mph; two Westinghouse J34-WE-32 engines, located side-by-side in the aft fuselage; one crew; sweptback, mid-wing design with steel spar; ailerons and elevator are combined (called Ailavator) and do away with the conventional horizontal tail surface; control surfaces are constructed of Metalite; tricycle-type landing gear.

Performance and specification figures are highly classified. The aircraft is in production and the first one off the line is expected out of the factory early in spring.



BELL AIRCRAFT CORP.

Supersonic Research Aircraft,

Model X-1 (USAF)

Design maximum speed, 1700 mph at 80,000 ft; landing speed, 110 mph; rate of climb, 13,800 fpm (ground takeoff); range, 2½ min, full power; 10 min if engine units used one at a time; span, 28 ft; length, 31 ft; height, 10 ft 10 in;

empty weight, 5800 lbs; gross weight, 14,500 lbs; one, four-unit Reaction Motors 6000C4 rocket engine, located in the tail; fuel consumption, 8177 lbs in 2½ min; wing loading, 100 psf; mid-wing, all-metal design; tricycle landing.

CONSOLIDATED VULTEE AIRCRAFT CORP.

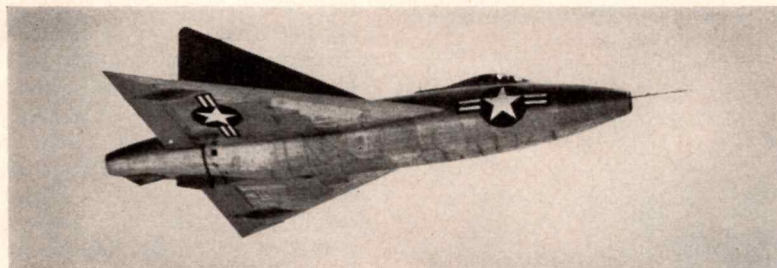
Flying Boat, Navy XP5Y-1



Gross weight, over 120,000 lbs; four Allison XT40-A-4 turboprop engines located in four wing nacelles, turning eight counter-rotating propellers; 11 crew; high-wing, all-metal construction, with metal control surfaces; new 10-to-1 hydro hull.

This is first U. S. aircraft to be equipped with turboprops in this

country. It is designed for over-water search and rescue, patrols and low-altitude bombardment. Performance and specification figures have not been released. Although photograph shows the plane without powerplants, it is understood that the engines are now in place and ground and water tests have begun.



CONSOLIDATED

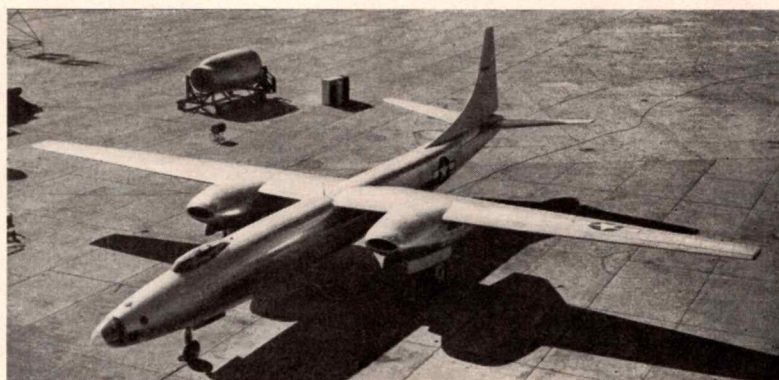
Experimental Interceptor,
Model 7002 (USAF XF-92A)

Span, 31 ft 4 in; length, 41 ft 4 in; height, 11 ft 8 in; empty weight, 9078 lbs; gross weight, 13,600 lbs; one Allison J33-A-23 turbojet, located in the aft part of the fuselage; one crew; mid-wing, all-metal design, with metal control surfaces; has "elevons" which combine elevator and aileron actions; tricycle landing gear; main wheels 26-in diameter, nose wheel 19-in diameter; Goodyear brakes; 24-v, 300-amp electrical system.

Manufacturer claims it to be the world's first delta-wing airplane. Used for flight research on this planform and, consequently, carries no armament. Design performance figures have not been revealed.

Two Westinghouse J34 turbojet engines located inside the fuselage; two crew; mid-wing type with all-metal construction, including control surfaces; tricycle landing gear. The F3D is supplied with electronic equipment for radar tracking and is armed heavily. Although in-

formation on specifications is restricted, the aircraft is a large fighter and no doubt is designed for long-range missions. Crew seating is side-by-side and emergency bail-out is accomplished through a special exit on the under side of the aircraft.

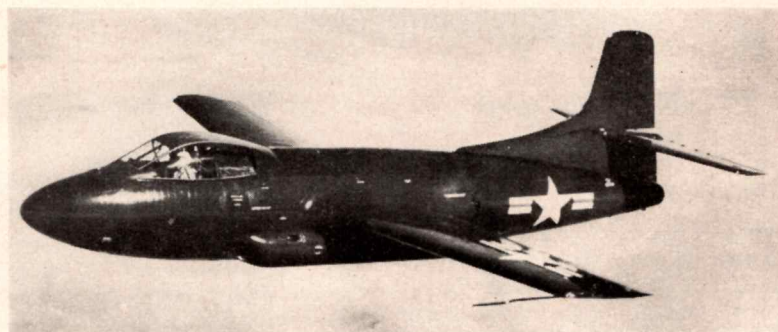


CONSOLIDATED

Medium Bomber, USAF XB-46

Cruising speed, over 500 mph; service ceiling, over 40,000 ft; span, 113 ft; length, 109 ft 7 in; height, 28 ft; empty weight, 48,450 lbs; gross weight, 91,000 lbs; four General Electric TG-180 (now Allison J35) turbojets located in pairs inside two wing nacelles; three crew; fuel capacity, over 4500 gals; high-wing, all-metal construction, with metal control surfaces; tricycle landing gear; main wheels 65-in diameter, nose wheel 32-in; Goodyear brakes; 24-v electrical system; carries four .50-cal machine guns.

The XB-46 features high-pressure, all-pneumatic systems — no hydraulic operations whatsoever. It has a greater bomb capacity than any of the wartime "heavy" bombers.



DOUGLAS AIRCRAFT CO., INC.

Night Fighter,

Navy F3D Skyknight



DOUGLAS

Research Aircraft, Navy D-558-2 Skyrocket

Span, 25 ft; length, 45 ft 3 in; height, 11 ft 6 in; gross weight, 15,000 lbs; powered by one Westinghouse J34 turbojet and one Reaction Motors rocket engine—both located inside the fuselage; one crew; mid-wing, all-metal design, with metal control surfaces; tricycle-type landing gear. The D-558-2 is said to be flown at supersonic speeds regularly at its test base. The jet-cum-rocket powerplant installation makes it possible for the plane to leave the ground and land comfortably under its own gas-turbine power. The rocket engine is brought into play to achieve the extra speeds desired for supersonic-flight research.

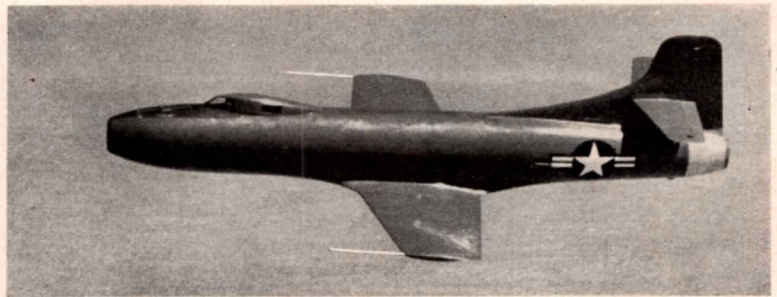


LOCKHEED AIRCRAFT CORP.

Fighter, USAF F-80C

Maximum speed, 580 mph; landing speed, 117 mph; rate of climb, 7000 fpm; service ceiling, 39,300 ft; span, 38 ft 10½ in; length, 34 ft 6 in; height, 11 ft 4 in; empty weight, 8215 lbs; gross weight, 15,336 lbs; one Allison J33-A-23 engine, located inside the fuselage aft of the

pilot; one crew; fuel capacity, 755 gals, with tip tanks; wing loading, 64.6 psf; power loading, 3.5-lb/lb thrust; low-wing, all-metal construction, with metal control surfaces; tricycle landing gear; armament, six .50-cal machine guns, rockets and two 2000-lb bombs.



DOUGLAS

Research Aircraft

Maximum speed 650 mph; span, 25 ft; length, 35 ft 9 in; height, 12 ft 2 in; gross weight, 10,000 lbs; one Allison J35 turbojet located inside the fuselage; one crew; low-wing, all-metal construction, with metal control surfaces; tricycle landing gear.

The D-558 established a world's

Navy D-558 Skystreak

speed record in 1947 when it was flown at an average speed of 650.6 mph during four passes over an official course. It is employed in subsonic-flight research; carries 500 lbs of scientific recording equipment which measures pressure variations at 400 points on the wing and tail.



GRUMMAN AIRCRAFT ENGINEERING CORP.

Fighter-bomber

One Pratt & Whitney J-42 turbojet engine located inside the fuselage; behind the pilot; one crew; low-wing, all-metal design, with metal control surfaces; tricycle landing

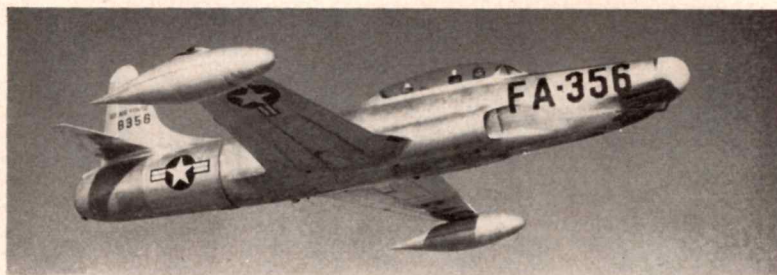
Navy F9F-2 Panther

gear; armed with four 20-mm cannon. The F9F-3 is the same basic airplane, but is supplied with an Allison J33-A-7 turbojet to keep this carrier-based aircraft from becoming dependent upon one source of powerplant supply. The Panther's wing panels fold upward for handy stowage and the fuselage separates handily for quick maintenance operations. Although specifications are unavailable, this plane goes well beyond the 600-mph mark and is slated as one of the Navy's first-line fighters.

LOCKHEED

All-weather Fighter, USAF F-94A

Maximum speed, over 600 mph; landing speed, 122 mph; service ceiling, 46,000 ft; span, 33 ft 10½ in; length, 40 ft 1½ in; height, 12 ft 8 in; empty weight, 9638 lbs; gross weight, 15,710 lbs; one Allison J33-A-33 turbojet, located inside the



fuselage aft of the cockpit; two crew; fuel capacity, 684 gals; wing loading, 64.5 psf; power loading,

3-lb/lb thrust; low-wing, all-metal construction, with metal control surfaces; tricycle landing gear.

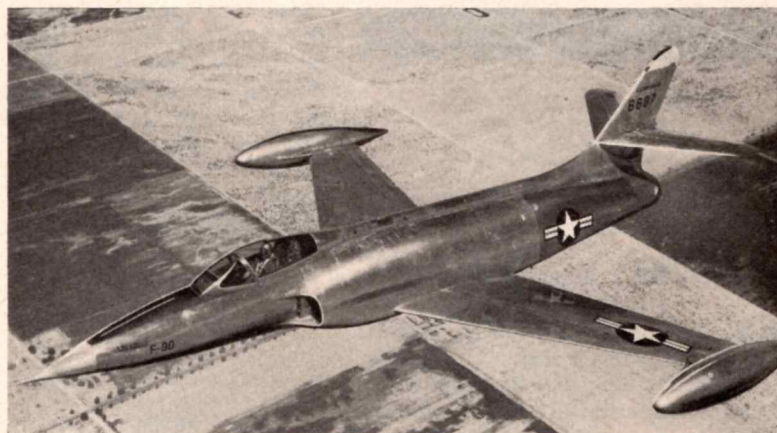
Piston engine-powered military aircraft are described in the Transport Section, beginning on page 67, and in the Warplanes Chart on page 47. Specifications on jet powerplants follow; reciprocating engines are described in the Piston Engine Section, beginning on page 91.

LOCKHEED AIRCRAFT CORP.

Penetration Fighter, USAF F-90

Span, approx. 40 ft; length, approx. 56 ft; height, approx. 16 ft; weight, approx. 26,000 lbs; two Westinghouse 24C turbojets located in the fuselage aft of the pilot; one crew; all-metal construction with metal control surfaces; wing sweepback, 35°; tricycle landing gear.

Cockpit is pressurized and air-conditioned and incorporates a pilot ejection seat. Performance details are classified.



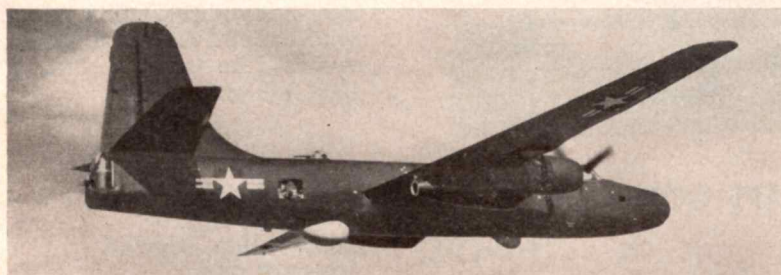
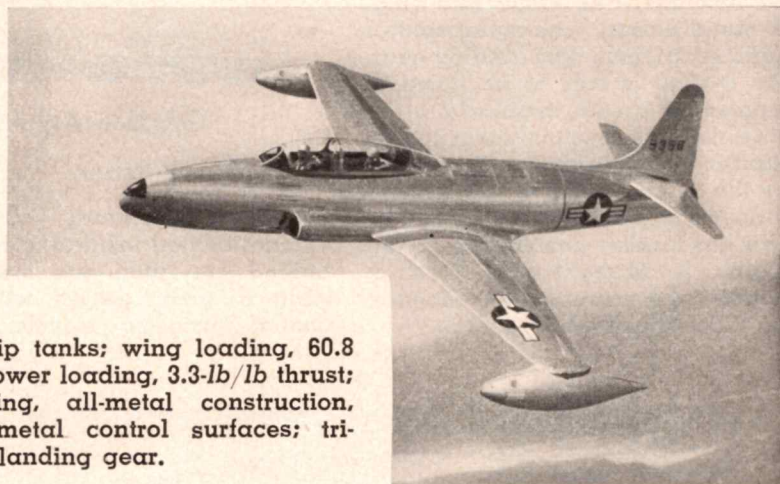
LOCKHEED

Jet Trainer,

USAF T-33A; Navy TO-2

Maximum speed, 580 mph; landing speed, 117 mph; rate of climb, 7625 fpm; service ceiling, 40,400 ft; span, 38 ft 10½ in; length, 37 ft 8½ in; height, 11 ft 8½ in; empty weight, 8084 lbs; gross weight, 14,442 lbs; one Allison J33-A-23 turbojet, located inside the fuselage aft of the cockpit; two crew, seated in tandem; fuel capacity, 683 gals

with tip tanks; wing loading, 60.8 psf; power loading, 3.3-lb/lb thrust; low-wing, all-metal construction, with metal control surfaces; tricycle landing gear.



THE GLENN L. MARTIN CO.

Land-based Reconnaissance

Cruising range, 3000 mi; span, 114 ft; length, 85 ft; gross weight, over 80,000 lbs; two Allison J33 turbojets installed in the aft portions of the

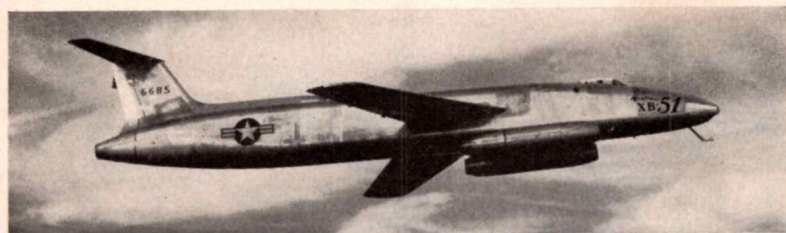
Navy P4M-1 Mercator

twin engine nacelles on the wing which house propeller-driving Pratt & Whitney R-4360 piston engines; nine crew; tricycle gear.

The Mercator, now in production, looks like a regular twin-engined aircraft. However, in each nacelle, behind the reciprocating engine is a turbojet which may be used in conjunction with the propeller thrust, or independently. The plane carries the latest types of radar and other electronic equipment and is armed heavily.

Target Drone and Rocket

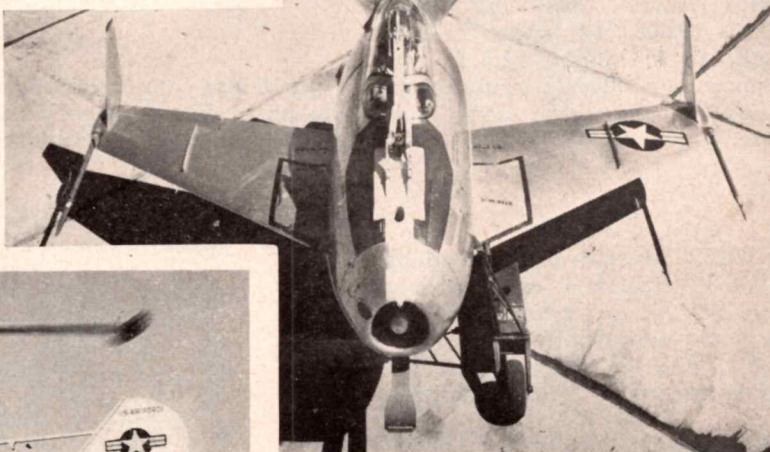
Martin is building the KDM-1 radio-controlled drone, powered by a 20-in Marquardt ramjet, and the Viking rocket with Reaction Motors engine.



MARTIN

Lighter Bomber, USAF XB-51

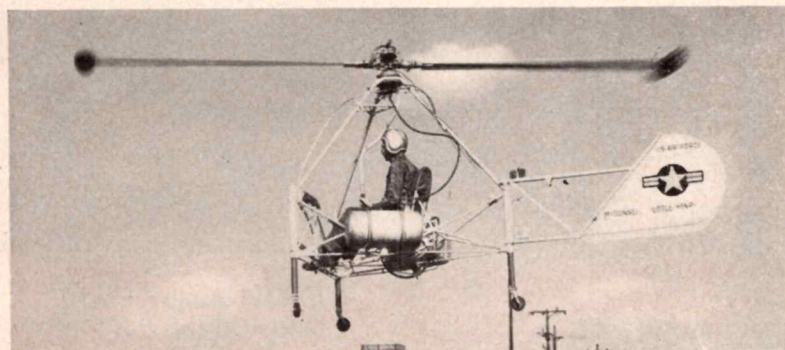
Span, 55 ft; length, 80 ft; height, 17 ft; three General Electric J47 turbojet engines—two mounted externally underneath the fuselage and one inside the aft fuselage; two crew; an all-metal, sweptback, mid-wing design; bicycle landing gear.



McDONNELL

"Parasite" Fighter, USAF XF-85

Span, 21 ft; length, 15 ft; height, 8 ft; one Westinghouse J34-WE-22 turbojet, located inside the fuselage; one crew; all-metal construction with sweptback wing.



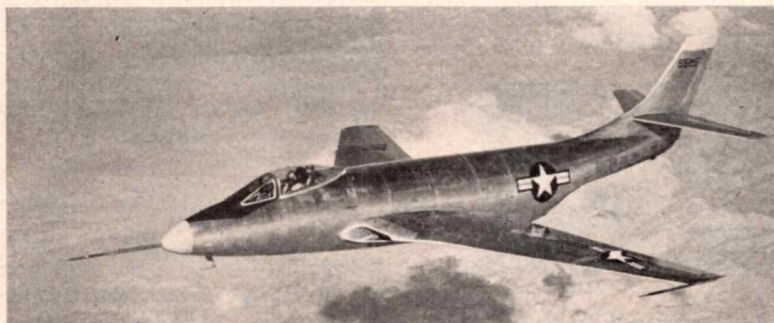
McDONNELL AIRCRAFT CORP.

Jet-powered Helicopter

Model 38 Little Henry

High speed, 50 mph; gross weight, 630 lbs; empty weight, 280 lbs; one, two-bladed rotor, 18 ft in diameter; all-metal construction; rotor rpm, 640 at cruising; fuselage length, 12½ ft; height to top of rotor, 7 ft; two McDonnell ramjet engines, weighing 10 lbs each, are located on the rotor blade tips; two-place.

This "aerial motorcycle" is a flying test stand for the evaluation of the basic idea the ramjet helicopter. The structure is entirely open. The principle is believed to be usable equally for numerous civil and military operations. Early flights were conducted with propane as fuel; jets which will utilize automotive gasoline are now in use.



Penetration Fighter

McDONNELL

USAF XF-88 Voodoo

Top speed, approx. 700 mph; service ceiling, 40,000 ft; no wind, sea-level takeoff over 50-ft obstacle, 3700 ft; landing, 3000 ft; normal

range, 1725 ft miles; gross weight, approx. 15,000 lbs; wing loading, 65.9 psf; span, approx. 40 ft; length, 55 ft; height, 15 ft; two Westing-

The XF-85 is designed to operate from the bomb bay of a large bomber—taking off and landing while the "mother" plane is in flight by means of an engaging hook on the "parasite" and a retracting "trapeze" on the bomber. The wings of the XF-85 fold to make entry into the bomb bay possible; the X-type tail surfaces are small enough to pass through the limited opening. The little fighter has no landing gear, except a nose skid for emergency landings. The short fuselage houses the pilot, powerplant, fuel supply and armament. Two were ordered by the Air Force.

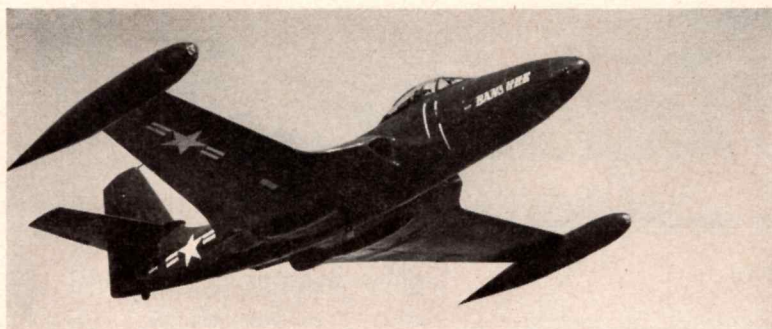
house J34 turbojets located inside the fuselage; one crew; tricycle landing gear; sweptback wing.

The XF-88 has a high rate of climb for fast interception; can be used for extended cruise during long-range attack missions or may be employed in a ground-troop supporting role. Firepower includes guns, rockets and bombs. Of the two experimental models built, the second is equipped with McDonnell-developed, short afterburners.

McDONNELL

Carrier-based Fighter, Navy F2H-1 Banshee

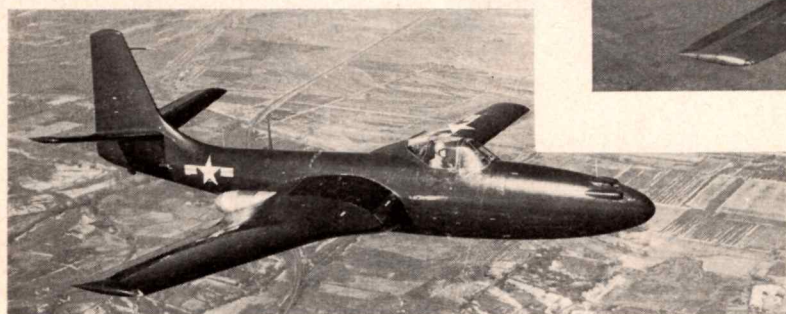
Top speed, over 575 mph at sea level; cruising speed, over 325 mph; climb first min, over 9000 fpm; service ceiling, over 50,000 ft; no wind, sea-level takeoff, 1270 ft; normal range, 2000 mi; gross weight, 16,000 lbs; span, 41.5 ft; length, 40 ft; height, 14.5 ft; two Westinghouse J34-WE-22 turbojets, located in the wing root; fuel capacity, over 5000 lbs.



Four 20-mm cannon are mounted in the nose; a nosewheel "kneeling" installation makes it possible to

stack more aircraft on a carrier deck. A Banshee holds the U. S. altitude record of 52,000 ft for jets.

The F2H-2 Banshee is powered by J34-WE-34 turbojets and grosses 19,000 lbs. An order for 56 F2H-1's has been completed; 179 of the F2H-2's, with tip tanks, are in production, including 14 night fighters.



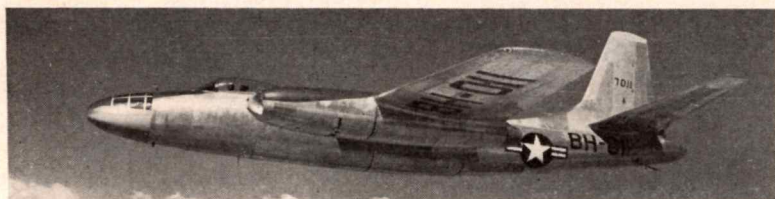
McDONNELL

Carrier-based Fighter

High speed, over 450 mph; cruising, over 300 mph; climb, over 4000 fpm; service ceiling, over 35,000 ft; no wind, sea-level takeoff, 1165 ft; gross weight, 12,000 lbs; span, 41 ft; length, 39 ft; height, 14 ft; two Westinghouse J30-WE-20 turbojets, located in wing root; one crew; tri-

Navy FH-1 Phantom

cycle landing gear. Sixty Phantoms have been produced. They are armed with four .50-cal machine guns and may be equipped with rocket launchers and dropable, belly fuel tanks. Wing panels fold upward for stowage aboard carriers.



NORTH AMERICAN

Maximum speed, in 550-mph class; service ceiling, over 40,000 ft; tactical radius, over 800 mi; span, 89½ ft; length, 74 ft; height, 25 ft; gross weight, 82,600 lbs; wing loading, 70.3 psf; bomb load, over 10 tons; four General Electric J47A turbojet

Bomber, USAF B-45 Tornado

engines, located in two wing nacelles; all-metal construction; four crew; tricycle landing gear; Bendix brakes and shock units. The B-45 carries a bomb load equal to wartime "heavies," although it is classed technically as a light

NORTH AMERICAN AVIATION, INC.

Attack Bomber, Navy AJ-1

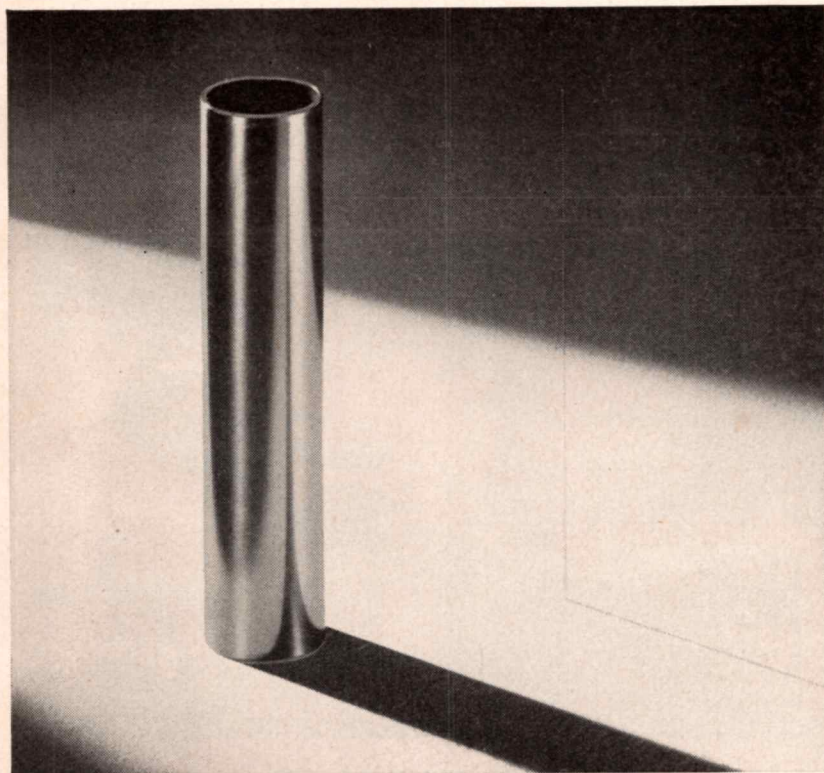
The AJ-1 is powered by three engines: two Pratt & Whitney Double Wasps, driving four-bladed Hamilton Standard propellers, in nacelles on the wing, and one General Electric TG-180 (now Allison J35) turbojet located inside the tail section of the fuselage. The reciprocating engines are employed for normal flight; the turbojet can be cut in for takeoff assist and for spurts of high speed. Originally designed for large-carrier operations, the attackers' outer wing panels fold upward and the vertical tail folds horizontally for easier handling aboard ship. It carries a crew of three and grosses approximately 55,000 lbs; performance figures are classified.

XF-93 Penetration Fighter

The prototype North American XF-93, said to be a heavier version of the basic F-86, has a Pratt & Whitney J42 turbojet.

bomber. Flaps and landing gear are actuated hydraulically; trim tabs operate electrically; hydraulic boost is provided on control surfaces. The USAF placed an order for 139 Tornadoes, some of which have been delivered.

Can You See Two Tubes?



● There were actually *two* tubes in this unretouched photograph. One at the right was so fine—less than the diameter of a human hair!—that the screen in the printing plate almost eliminated it. The other is a Superior $\frac{5}{8}$ " O.D. tube.

Between these two sizes Superior makes tubing in all practical metals, alloys, forms, finishes, and tolerances.

Between these two sizes Superior is superior for know-how, facilities, metallurgy and technology in tubing.

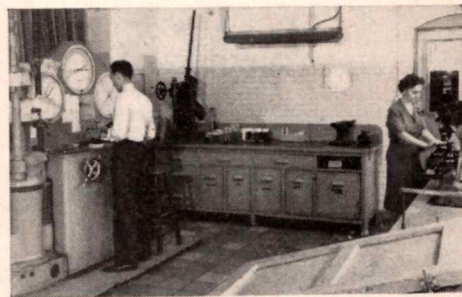
There are 55 Superior Distributors in the U. S. and Canada. You can obtain excellent help, technical assistance, and advice from the one nearest you... and can probably obtain just the tubing you need from his adequate warehouse stock.

If you do not know your Superior distributor write directly to us for immediate attention to your tubing problems or tubing needs. Ask for Bulletin 31. Superior Tube Company, 2030 Germantown Ave., Norristown, Pennsylvania.

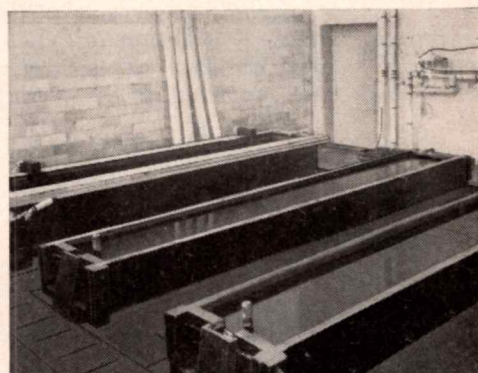
Which Is The Better For Your Product...

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One of the pickling rooms used to clean and pickle tubing. Stainless steels are often used for their appearance value as well as their resistance to corrosion and high temperature. For this reason pickling is more carefully controlled for Stainless steels than for other materials.



Partial view of the dies required for cold drawing and sinking of Superior specialty tubing. Our know-how in die design helps make Superior tubing superior.

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All analyses .010" to $\frac{3}{8}$ " O.D.
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NORTH AMERICAN

Fighter, USAF F-86 Sabre

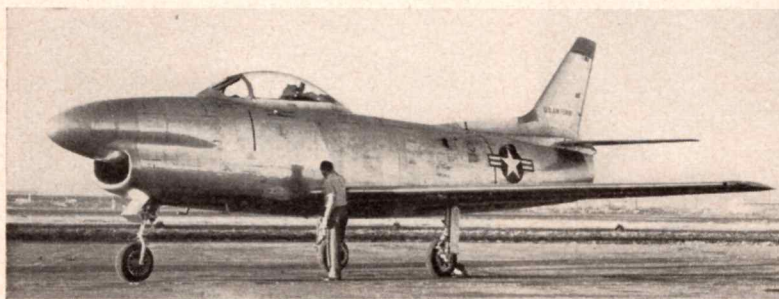
Top speed, approx. 700 mph; service ceiling, over 40,000 ft; tactical radius, over 500 mi; span, 37 ft; length, 37 ft; height, 14 ft; gross weight, 13,715 lbs; one crew; low-wing, sweptback design of all-metal construction; one General Electric J47A turbojet engine, located inside the fuselage; straight-through, nose air duct; tricycle landing gear; Bendix wheels and brakes; Cleveland shock units.

The Sabre holds the world's official speed record of 670.98 mph, made with a combat load of guns and ammunition, although it has been flown faster than 700 mph unofficially since that record was set.



The first U. S. sweptback fighter, it is claimed to delay the formation of compressibility shock waves so that it becomes a useful fighter at

high subsonic speeds. Equipped with the latest radar and navigational aids. The Air Force ordered 554; some have been delivered.

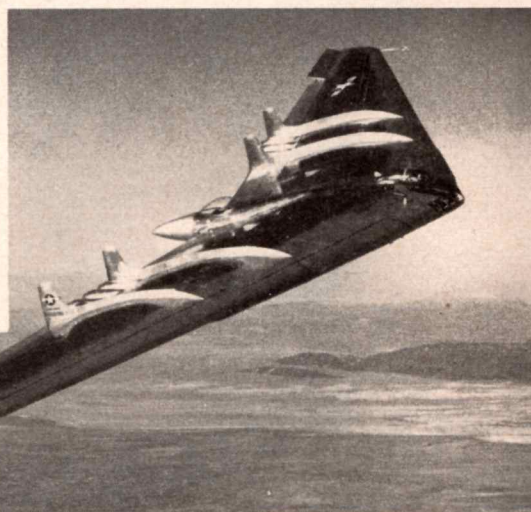


NORTH AMERICAN

Fighter, USAF YF-86D

Span, 37 ft; length, 41 ft; height, 14 ft; one General Electric J47 turbojet engine, with afterburner; low-wing, sweptback, all-metal design; one crew.

Externally, the YF-86D differs from the F-86 in size and in the placement of the engine intake air duct below the nose of the aircraft. It has been given added thrust for better high-altitude performance, and is, in all probability, an all-weather design.



NORTHROP AIRCRAFT, INC.

Bomber, USAF YB-49

Speed, in the 500-mph class; span, 172 ft; length, 53 ft; height, 15 ft; empty weight, 88,100 lbs; gross weight, 213,000 lbs; eight Allison J35 turbojet engines, enclosed inside the wing—installed in two

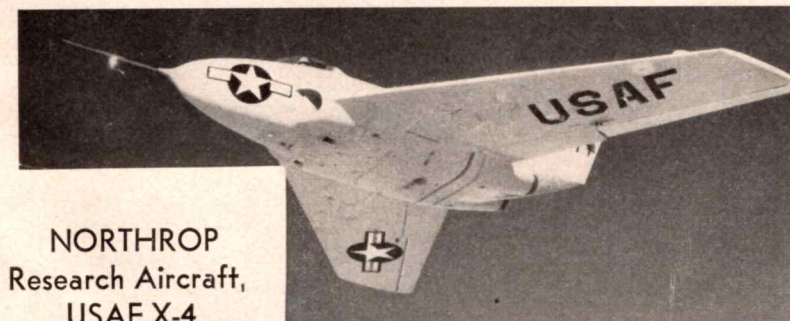
Flying Wing

groups of four; seven crew; tricycle landing gear; main wheel, 66-in diameter; nose wheel, 56-in diameter; all-metal, tailless aircraft using "elevon" controls which act as elevators and ailerons.

The YB-49 set a jet-aircraft record by remaining aloft for nine hrs 30 min without refueling; distance covered was 3458 mi; the flight took place between 35,000 and 40,000 ft. The flying wing carries an unusually high useful load and frequently has been flown with only one bank of its engines operating—flying along in a yawed position without an appreciable increase in drag.

"Elevons" provide both elevator and ailerons; the tail surface consists only of a vertical stabilizer and rudder.

(Continued on following page)



NORTHROP Research Aircraft, USAF X-4

Span, approx. 25 ft; length, approx. 20 ft; height, approx. 15 ft; gross weight, approx. 7000 lbs; two Allison J35 turbojet engines, located in the lower fuselage; one crew.

Of semi-tailless configuration, the X-4 is designed to explore the stability and flight characteristics of sweptback, all-wing aircraft at speeds within the sonic range.



NORTHROP

All-weather Interceptor, USAF F-89 Scorpion

Speed, in the 600-mph class; service ceiling, over 40,000 ft; span, approx. 50 ft; length, approx. 50 ft; height, approx. 15 ft; gross weight, over 30,000 lbs; two Allison J35 turbojet engines, installed side-by-side in the lower fuselage; two crew; all-metal, mid-wing design, with wingtip tanks; tricycle landing gear.

The Scorpion is equipped with "decelerons," split-type control surfaces which serve as ailerons, landing flaps and dive brakes. Elaborate electronic devices make it possible to locate and hunt down other aircraft and ground installations, regardless of the hour or weather.



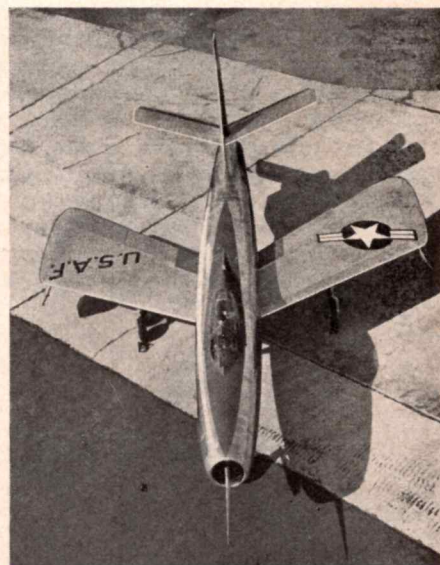
REPUBLIC AVIATION CORP.

Fighter, USAF F-84E Thunderjet

Maximum speed, 600 mph; landing speed, 120 mph; service ceiling, over 45,000 ft; cruising range, over 2000 mi; span, 37 ft; length, 38 ft; height, 15 ft; empty weight, 10,000 lbs; gross weight, over 22,000 lbs; one Allison J35-A-17 turbojet engine, located inside the fuselage; open nose for engine air duct; one crew; mid-wing, all-metal design; tricycle landing gear; armament, six .50-cal machine guns and up to

32 high-velocity rockets, or two "Tiny Tim" rockets or 2000-lb bombs.

The Thunderjet has been highly developed as a tactical support fighter-attack-bomber. Various Air Force units use it in operational tactics both at home and abroad, and some National Guard units are receiving F-84's for jet indoctrination.



REPUBLIC

High-altitude Interceptor, USAF XF-91

Span, over 45 ft; length, 30 ft; height, 18 ft; empty weight, 18,000 lbs; one General Electric J47 turbojet engine, with an afterburner, located inside the fuselage; open nose for engine air duct; one crew; mid-wing, sweptback, all-metal design; tricycle-type landing gear with dual wheels in tandem under each thin wing; single nosewheel.

The XF-91 employs inverse taper on the wing, which makes the wing wider at the tips than at the fuselage intersection, said to reduce wingtip stalls due to early loss of lift. Leading-edge slots are claimed to assist in providing an unbelievably low flying speed for a jet aircraft. Another feature is a variable-incidence wing, permitting a high angle of attack for takeoffs and landings and a lower angle for high-speed flight. Four rocket motors are to be installed at a future date to boost the rate of climb and for additional spurts of power for combat.

U. S. JET AND ROCKET POWERPLANTS



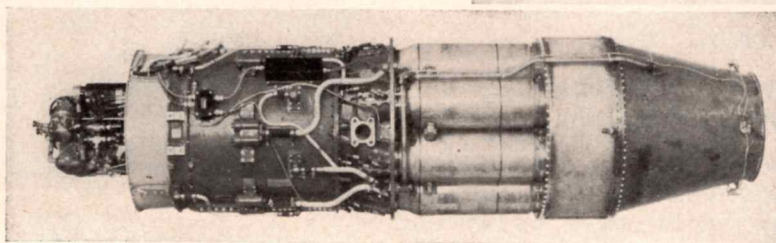
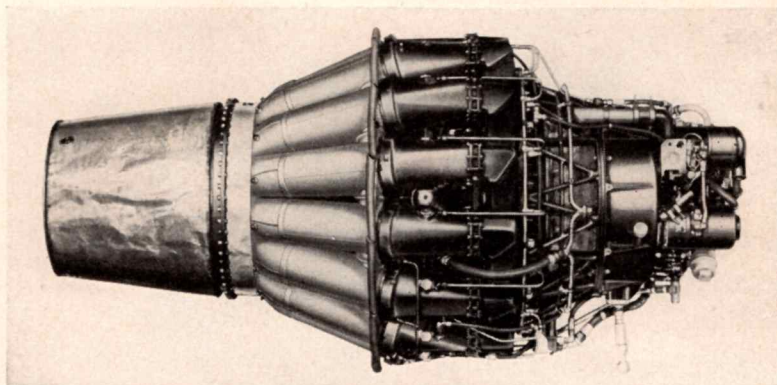
ALLISON

Turboprop, Model 500

(Navy XT40)

Horsepower, 5500; fuel consumption, 0.63 lb/hp/hr; compression ratio, 6.3 to 1; weight, 2500 lbs; height, 25 in; width, 39 in; starter, AiResearch pneumatic; fuel pumps, Pesco; fuel control, Bendix; automatic control, Allison; propeller, six-blade, contra-rotating Aeroproducts.

Two axial-flow gas turbine power sections (XT38) drive a dual-rotation propeller through a common reduction gear. The power sections are joined to make, in effect, a single unit; extension shafts connect them with the reduction gear, making "remote" installations possible. Each power section can operate the contra-props independently, when desired. The first installation is in the Convair XP5Y-1.



ALLISON DIV., GENERAL MOTORS CORPORATION

Turbojet, Model 400 (USAF J33-A-23)

Takeoff, static thrust with water-alcohol injection, 5400 lbs at 11,750 rpm; takeoff, static thrust, 4600 lbs at 11,750 rpm; normal, static thrust, 3900 lbs at 11,250 rpm; cruising, static thrust, 3600 lbs at 11,000 rpm; compression ratio, 4.4 to 1; airflow, 86 lb/sec at 11,750 rpm; rated exhaust-gas temperature, 1265° F; fuel grade, JP1 kerosene or 100/130 gasoline; fuel consumption, cruising, 1.12 lb/lb/thrust/hr; gear-type oil-scavenge pump; two ignitor plugs and two transformers in shielded ignition system; diameter, 50.5 in; length, 103 in; weight, 1795 lbs; water injection, optional; single-stage, centrifugal aluminum-alloy compressor, taking in air from both sides; 14 stainless-steel combustion chambers; single-stage, 54-blade turbine.

First jet to pass 150-hr type test. Currently powers Lockheed F-80C and F-33 trainer; earlier models power Grumman F9F-3. Type has accumulated more than 150,000 hrs flying time; present time between overhauls is 300 hrs. The J33-A-10 is a Navy configuration of the same engine; powers the North American AJ-1 and Martin P4M-1. The J33-A-33 has the same specifications but includes an afterburner; it powers the Lockheed F-94A.

ALLISON

Turbojet, Model 450

(USAF J35-A-17)

Takeoff, static thrust, 5000 lbs at 7800 rpm; normal, static thrust, 4240 lbs at 7400 lbs; cruising, static thrust, 4000 lbs at 7200 rpm; 5-to-1 compression ratio; mass airflow, 85 lb/sec at 7800 rpm; exhaust gas temperature, 1265° F after the turbine; two ignitor plugs and two transformers in the shielded ignition system; fuel grade, JP1 kerosene; fuel consumption, cruising, 1.05 lb/lb thrust/hr; rotor-type oil-scavenge pump; diameter, 37 in; length (with tail tube), 146 in;

weight, 2260 lbs; 11-stage, axial-flow compressor with air entering the front of the engine; 8 combustion chambers; a 26-blade, stainless-steel turbine.

Powers Republic F-84E. Earlier models power the North American FJ-1, Northrop RB-35 and Northrop F-89A. The Model 450 powered the Navy-Douglas D-558 to a world's speed record of 650.6 mph in 1947. Present time between overhauls is 150 hrs.

ALLISON

Turboprop, Model 501 (Navy XT38)

Horsepower, 2750; fuel consumption, 0.63 lb/hp/hr; compression ratio, 6.3 to 1; weight, 1225 lbs; diameter, 20 in; length, 84 in; starter, AiResearch pneumatic; fuel pumps, Pesco; fuel control, Bendix; automatic control, Allison; three-blade Aeroproducts propeller; axial-flow, 17-stage compressor; eight, can-type combustion chambers; four-stage turbine.

The XT38 drives a propeller through a reduction gear connected to the powerplant by extension shafts. Developed for the Navy; claimed to produce more power per lb of engine weight than any propeller-driving engine ever cleared for flight. Presently used experimentally as the fifth engine in a Boing B-17, by Allison Flight Test.

AEROJET ENGINEERING CORPORATION

Aerojet, said to be the largest developer and manufacturer of rocket devices in the country, is engaged in research, development and production of liquid and solid-fuel rocket powerplants, guided-missile sustaining motors and boosters, underwater rocket devices and liquid and solid-propellant jet-assisted takeoff (JATO) motors for aircraft.

BOEING AIRPLANE COMPANY

Turbojet, Model 500.

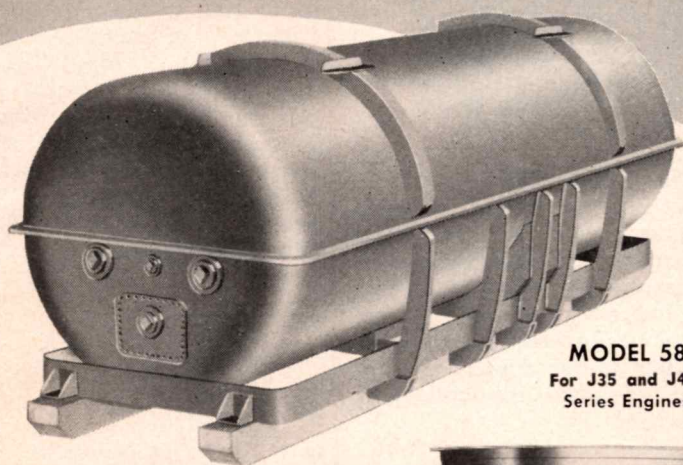
Takeoff thrust, 215 lbs at 38,000 rpm; continuous, 185 lbs at 36,000 rpm; fuel consumption, takeoff and continuous, 1.3 lb/lb thrust per hr; takeoff tailpipe gas temperature, 1300° F; continuous, 1250° F; continuous specific thrust, lb/sq ft of frontal area, 85; fuel grade, gaso-

line, kerosene or diesel fuel; weight, lb/lb of continuous thrust, 0.6; net weight, 111 lbs; frontal area, 2.18 sq ft; length, 3.17 ft; diameter, 20 in; exhaust diameter, 5 in; single-stage, centrifugal compressor; compression ratio, 3 to 1; inlet airflow, 3.2 lb/sec; bleed-off

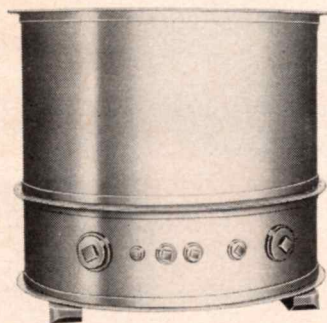
Bausenbach

LEADS IN DESIGN OF ACCEPTED

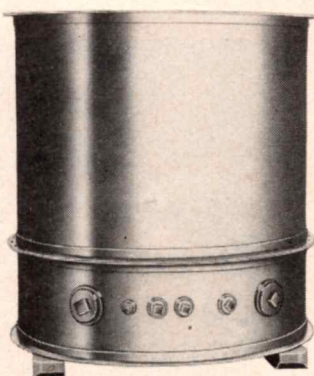
Shock Mounted
CONTAINERS



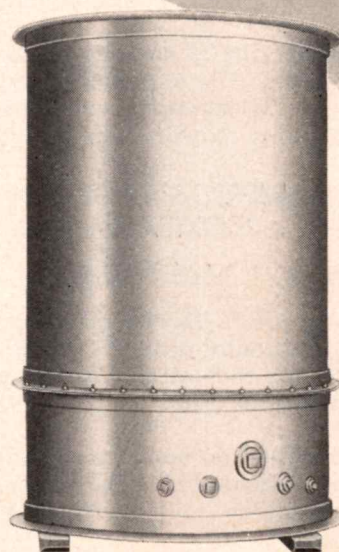
MODEL 58
For J35 and J47
Series Engines



MODEL 78
For R985 and R1340
Series Engines



MODEL 86
For R1300 and R1820
Series Engines



MODEL 87
For R3350 Series
Engines

These metal containers, engineered and manufactured by A. E. Bausenbach, Inc., have made it possible to completely protect aircraft gas turbine and reciprocating engines against the most extreme conditions encountered in handling, shipping and storing in all parts of the world.

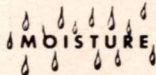
ISOLATE your product against damage



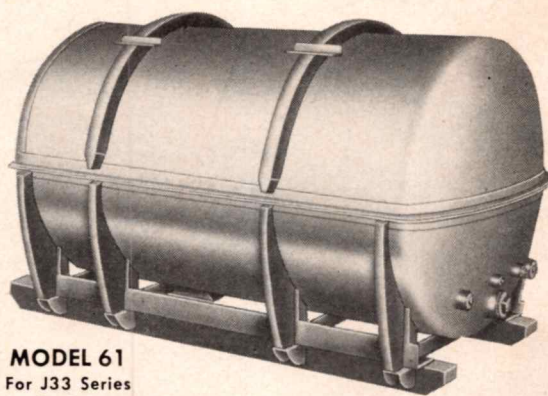
IMPACT



VIBRATION

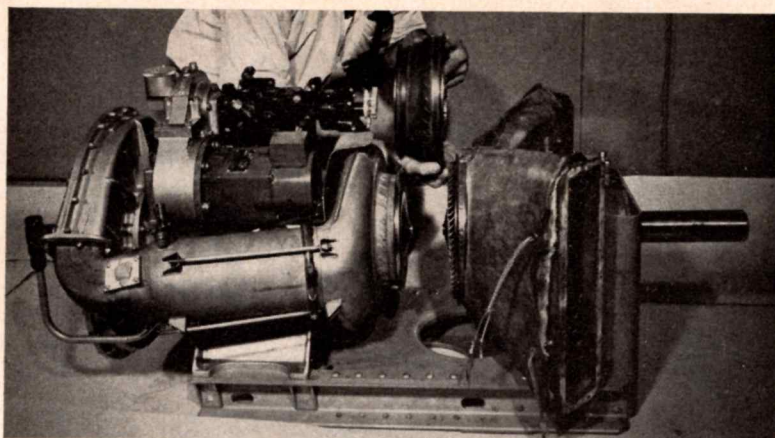


MOISTURE



MODEL 61
For J33 Series
Engines

A. E. Bausenbach, INCORPORATED
NINETEEN ALLEN STREET • BUFFALO 2, NEW YORK
Manufacturers of SHIPPING SUPPORTS • IMPACT ISOLATORS • MOISTURE BARRIERS
and METAL SHIPPING AND STORAGE CONTAINERS



FREDERIC FLADER, INC.

Turbojet, Model 124-J55-FF-1 (the "Sergeant")

Takeoff thrust, 770 lbs at 28,200 rpm; continuous thrust, 700 lbs at 26,800 rpm; takeoff fuel consumption, 1.64 lb/lb thrust per hr; takeoff tailpipe gas temperature, 1250° F; continuous, 1170° F; continuous specific thrust, 515 lbs/sq ft frontal area; fuel grade, AN-F-34; weight, 2.33 lb/lb of continuous thrust; net weight, 300 lbs; length, 79 in; diameter, 15.75 in; exhaust diameter, 8.75 in; compression ratio, 2.85 to 1; inlet airflow, 15.4 lb/sec; single-stage, reaction-type turbine; annular-type combustion chamber; Breeze generator and starter; Woodward governor.

air available, 1.2 lb/min; impulse-reaction-type turbine, single stage; two can-type combustion chambers; 30-amp, 28 v starter-generator.

The Model 502 is similar, basically; however, it is a turboprop type adaptable to aircraft, automotive, or stationary power uses. It pro-

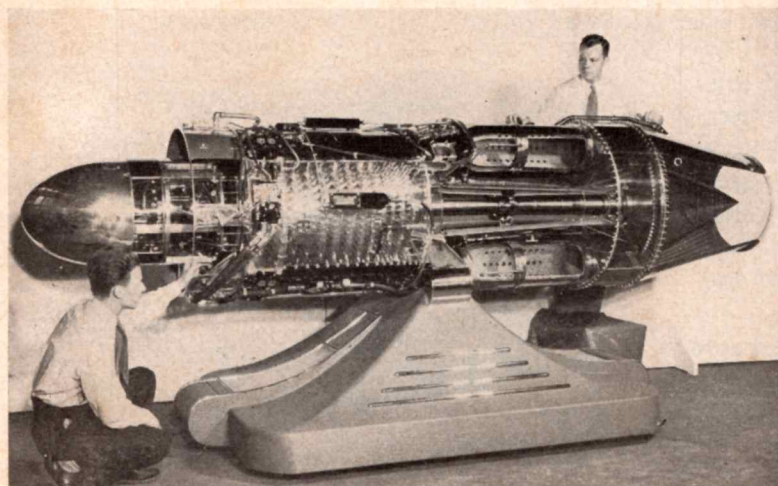
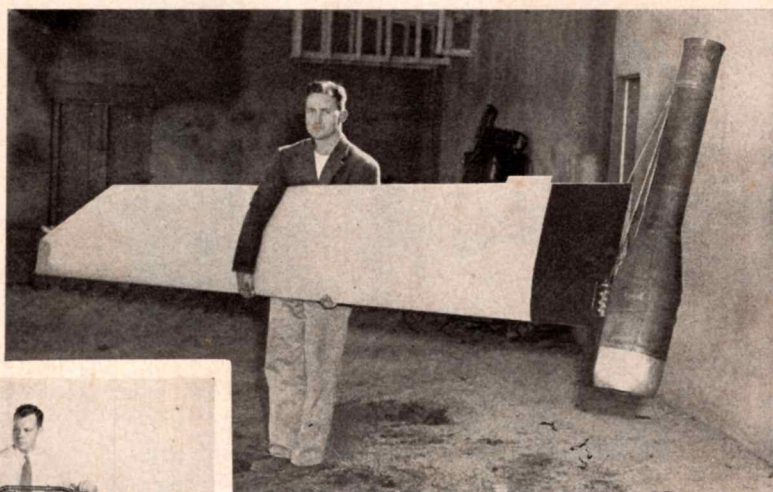
duces 200 hp at 2700 shaft rpm; 160 hp at 2450 rpm; and includes a secondary turbine, reduction gearing and shaft. Neither powerplant is ready for large-scale production, but each is past the experimental stage and is ready for service tests under controlled conditions in industrial applications.

AMERICAN HELICOPTER COMPANY, INC.

Pulsejet, Model AJ 8.75

Weight, 1b/lb of continuous thrust, 0.23; frontal area, 0.42 sq ft; length, 40 in; diameter, 8.75 in; exhaust diameter, 5 in.

Installed on each rotor-blade tip of the two-bladed, XA-5 experimental helicopter built by American Helicopter.



GENERAL ELECTRIC COMPANY

Turbojet, Model GE TG-190

(USAF J47)

Takeoff thrust, 5200+ lbs; fuel grade, JP1 kerosene or 100/130 gasoline; net weight, 2500 lbs; frontal area, 7.35 sq ft; length, 144

in; diameter, 36 3/4 in; exhaust diameter, 18 in; axial-flow compressor; 12 stages; inlet airflow, approx. 90 lb/sec; bleed-off air available, 225

lb/min; single-stage, axial-type turbine; 8 through-flow combustion chambers; General Electric generator and starter.

Developed under a USAF contract and is now being produced for the Boeing B-47, North American B-45 and F-86, Martin XB-51, Republic XF-91 and for pod-installation on the Convair B-36. The most powerful aircraft turbojet in production in the U. S. and the first axial-flow type to be certificated by the CAA for commercial use.

G. M. GIANNINI & COMPANY, INC.

Produces pulsejet powerplants in a range of sizes from four to 30 in in diameter; to include a thrust

range that meets a wide variety of applications such as targets, missiles, boosters and helicopters. These engines are of complete American design and have been used successfully in a number of installations. Detailed information on these Air Force-sponsored pulse-jets is in a restricted category.

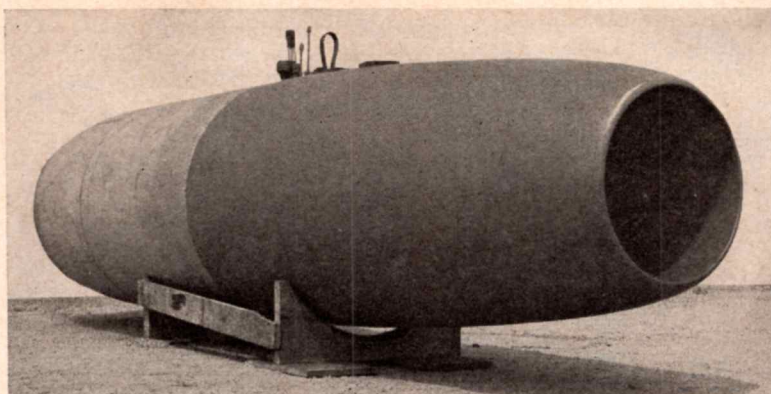
MARQUARDT AIRCRAFT COMPANY

Ramjet, Model C-30-1.0

Large, subsonic ramjet developed for the Air Force; has a diameter of 30 in and a design speed of 750 mph (roughly Mach 1.0 at sea level). At this speed, produces bet-

ter than 20 hp per lb of engine weight. Capable of powering pilotless aircraft or guided missiles.

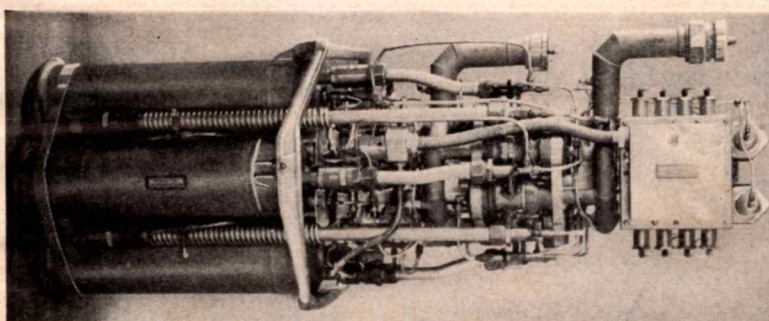
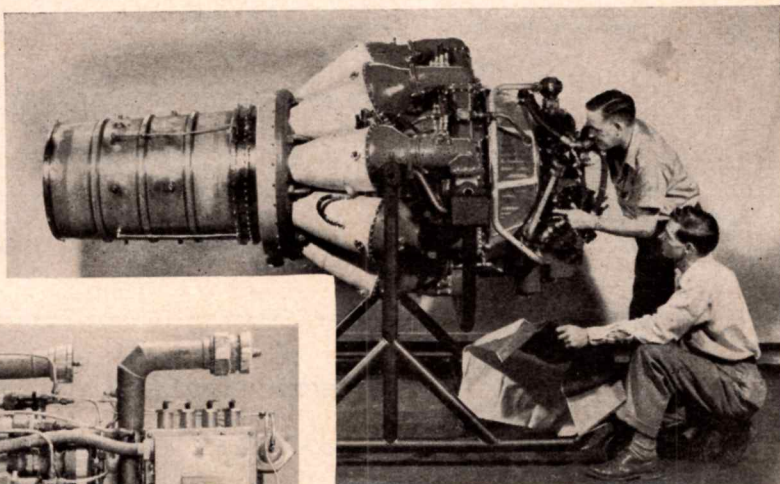
This, and a 20-in unit have been flight-tested on aircraft such as the Lockheed F-80.



REACTION MOTORS, INC.

Liquid Propellant Rocket Engine, Model RMI 6000C4

Sea level, static rated thrust, 6000 lbs; cylinder operation, one to four thrust increments at 1500 lbs each;



specific propellant consumption at rated thrust, 0.0053 lb/sec/lbs thrust; fuel grade, AN-A-18 and water; oxidizer, liquid oxygen; dry weight, 220 lbs; no. of thrust cylinders, four; type of thrust cylinder,

regenerative—fuel-cooled; ignition, Reaction Motors alcohol-oxygen igniters; propellant feed, pressurized.

Used presently in the Air Force X-1 research aircraft.

Turboprop, Model XT-37 ("Turbodyne II")

Axial-flow, multi-stage compressor and turbine; eight can-type combustion chambers.

Developed under a USAF contract and believed to be the world's most powerful aircraft engine; it was de-

PRATT & WHITNEY AIRCRAFT

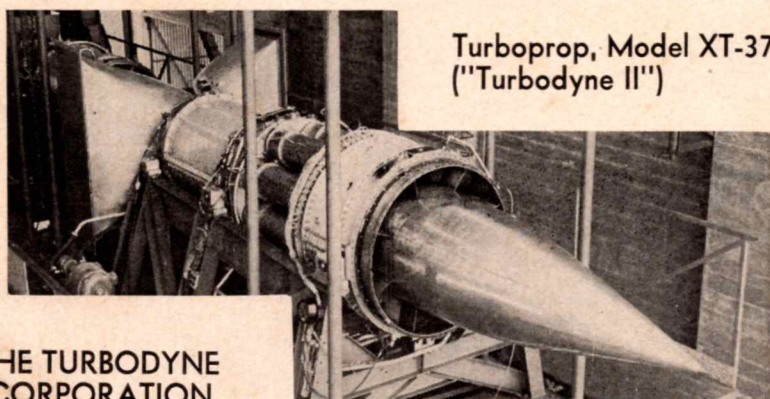
Turbojet, Model JT-6B

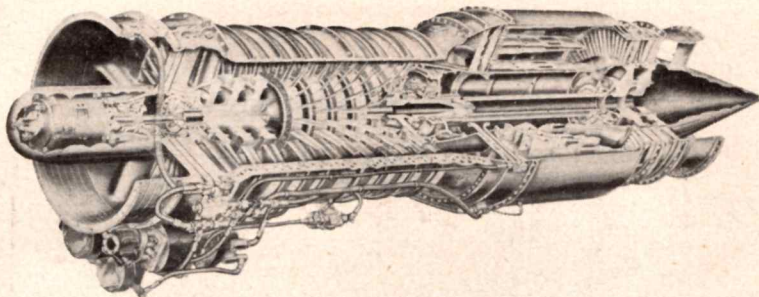
(the "Turbo-Wasp")

Takeoff thrust, 5000 lbs at 12,300 rpm; continuous thrust, 4000 lbs at 11,600 rpm; fuel consumption, takeoff, 1.12 lb/lb thrust per hr; continuous, 1.09 lb/lb thrust per hr; takeoff tailpipe gas temperature, 1365° F; continuous specific thrust, 300 lb/sq ft frontal area; fuel grade, 100/130; weight, 0.431 lb/lb of continuous thrust; net weight, 1723 lbs; frontal area, 13.36 sq ft; length, 103.25 in; diameter, 49.5 in; single-stage, centrifugal compressor; inlet airflow, 88 lb/sec; single-stage, axial-type turbine; nine "thru-flow" combustion chambers; fuel pump, Lucas; fuel control and governor, Bendix; starter and generator types are optional.

signed to produce 10,000 hp. Currently undergoing ground tests at the company's test facilities.

THE TURBODYNE CORPORATION





WESTINGHOUSE ELECTRIC CORPORATION

Turbojet, Model J34WE-22

Takeoff thrust, 3000 lbs at 12,500 rpm; Continuous thrust, 2290 lbs at 11,500 rpm; fuel consumption, take-off, 1.08 lb/lb thrust per hr; con-

tinuous, 1.07 lb/lb thrust per hr; takeoff tailpipe gas temperature, 1115° F; continuous, tailpipe gas temperature, 1025° F; continuous

specific thrust, 445 lb lb/sq ft frontal area; fuel grade, AN-F-48; weight, 0.52 lb/lb of continuous thrust; net weight, 1200 lbs; frontal area, 5.16 sq ft; length 120 in; diameter, 27 in; exhaust diameter, 15 in; 11-stage, axial-flow compressor; compression ratio, 3.65 to 1; inlet airflow, 58 lb/sec; bleed-off air available, 20 lb/min; two-stage, reaction type turbine; one, double-annular combustion chamber; generator not supplied; starter, Westinghouse; fuel pump, Pesco; governor and fuel control, Holley;

This engine powers the McDonnell F2H (two engines), and XF-85 and XF-88 (two engines); Chance Vought F6U and F7U (two engines); Douglas F3D and D558-II; and the Lockheed XF-90 (two engines).

JET AND ROCKET ADDENDA

Bell Aircraft Corp. is engaged in research and development work on reaction-type powerplants. However, all the company's work in

that field is highly classified and no information is releasable.

The Wright Aeronautical Div. of the Curtiss-Wright Corp. is develop-

ing ramjets and a turbojet under contract. The Curtiss Propeller Div. is building a rocket powerplant for the Bell X-2 research aircraft.

Jackie Does It Again!

MRS. JACQUELINE COCHRAN ODLUM, of Stamford, Conn., the nation's outstanding woman pilot, established her second world's record at Palm Springs, Calif., on Dec. 29, sending her converted North American F-51C *Mustang* around a 500-kilometer closed course at a speed of 436.981 mph.

Her plane, recently acquired from actor-pilot Jimmy Stewart, is the same aircraft in which Joe DeBona won the Bendix Trophy at the 1949 National Air Races in Cleveland. Mrs. Odlum, incidentally, is also a Bendix winner, having placed first in 1938, in 8 hrs, 10 min, 31 sec at a speed of 249.774 mph. She placed third in both the 1937 and 1948 races, but was the first woman pilot to finish on both occasions.

The aircraft in which Miss Cochran, as

she is more familiarly known, set her latest record was originally built as a P-51C-10 in 1943, converted to an F-6C photo-reconnaissance plane in 1944 and reconverted to an F-51C this fall.

Miss Cochran made the flight with no payload, under controlled conditions set by the Federation Aeronautique Internationale, with judges and timers appointed by the National Aeronautic Association. The 500-kilometer (310.685-mi) closed-course event was reestablished this past year by NAA, not having been in use since 1933. Thus, Miss Cochran has set the national, international and world records for that distance.

The holder of more aviation records than any other woman in the world, Miss Cochran is a past president of The Ninety-Nines, international woman pilots' organization, war-

time director of the WASPs, and holds a commission as Lieutenant Colonel in the Air Force Reserve. In addition to these achievements, Miss Cochran also holds the national altitude record for women of 30,052.43 ft, set in March 1939.

Practical Rocketry

DR. JAMES A. VAN ALLEN, director of upper atmospheric research at the Applied Physics Laboratory, Johns Hopkins University, will address a meeting of the American Rocket Society on the subject "Use of Rockets in Upper Atmospheric Research" on March 17 in the Engineering Societies Building, 29 West 39th St., New York.

He was one of the scientists aboard the *USS Norton Sound* during the recent experiments with guided missiles which were fired from the deck of the ship. His discussion is expected to include references to important developments such as the *Aerobee* and the *Wac Corporal*. A new "step rocket" is expected to be announced.

Fairchild Change

THE name of the Pilotless Planes Div. of the Fairchild Engine & Airplane Corp., at Farmingdale, N.Y., has been changed to Fairchild Guided Missiles Div.

This division, founded in 1945, is engaged chiefly in research, development and production of guided missiles and component parts, including guidance systems for the Navy.

JACQUELINE COCHRAN RECORDS

Event (Closed Course)	Speed (mph)	Date	Record (FAI Class)
2000 K	447.470	5/48	Inter. Open
1000 K	431.094	5/48	Inter. Womens
500 K	436.981	12/49	World Open
100 K	469.549	12/47	Inter. Womens
3 K	412.002	12/47	Inter. Womens
Maximum Speed	412.002	12/47	Inter. Womens

Event	Time	Speed (av.)	Date	Record
Transcontinental (Calif.-New York)	10 hrs/27 min/55 sec	234.776	9/38	Natl. Womens
Coastal	4 hrs/12 min/27 sec	278.130	12/37	Natl. Womens
(New York-Florida)				
Bendix Trophy Race .. (Calif.-Ohio)	10 hrs/29 min/ 4 sec	194.740	9/37	Natl. Womens
(Calif.-Ohio)	8 hrs/10 min/31 sec	249.774	9/38	Natl. Womens
(Calif.-Ohio)	4 hrs/35 min/ 7 sec	445.847	9/48	Natl. Open

1950 Annual Directory of TRANSPORT AIRCRAFT



AVRO Jetliner Model C-102 T. C. Pending

TYPE: Passenger, medium range; seats 40-60.

service ceiling 45,000 ft. Cruising range 2000 mi.

PERFORMANCE: Speed: maximum over 500 mph; cruising 450 mph; landing 95 mph. Rate of climb 3400 fpm;

SPECIFICATIONS: Wingspan 98 ft 1 in; length 82 ft 9 in; height 26 ft 6 in. Weight: empty 33,400 lbs; gross 65,000

lbs. Fuel capacity 2850 Imp gal. Wing: low; metal-covered aluminum spar; area 1151 sq ft; loading 59 psf. Fuselage: metal-covered monocoque. Metal-covered ailerons, elevator, rudder, flaps. Landing gear: tricycle; tire size: main 11.75 x 38, nose 7.75 x 26; liquid spring shock absorbers. Powerplant: four Rolls Royce Derwent V-17 turbojets.

NOTEWORTHY FEATURES

First medium-range jet transport. Pressurized cabin maintaining ground-level conditions up to 21,500 ft. Cargo and baggage compartment 216 cu ft. Outboard double-slotted flaps and inboard split flaps are used for takeoff and landing, and dive brakes for rapid descent. Anti-icing equipment is electro-thermal and provision is made for under-wing pressure refueling.

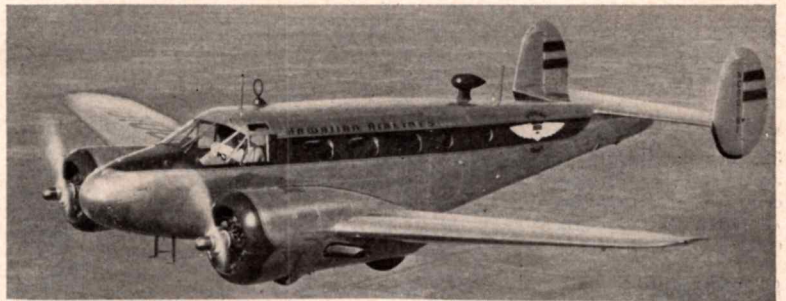
BEECHCRAFT Executive Model D-18S T. C. 765

TYPE: Passenger, executive, feeder; seats 9.

PERFORMANCE: Speed: maximum 230 mph at 5000 ft; cruising 211 mph at 10,000 ft; landing 77 mph. Rate of climb 1190 fpm; service ceiling 20,500 ft. Cruising range 908 mi; fuel consumption 47.5 gph.

SPECIFICATIONS: Wingspan 27 ft 7 in; length 34 ft; height 9 ft 3 in. Weight: empty 5635 lbs; gross 8750 lbs; power loading 9.7 lbs/hp. Fuel capacity 206 gals. Wings: low; metal-covered aluminum spar; area 349 sq ft;

loading 25.1 psf. Fuselage: metal-covered semi-monocoque. Landing gear: conventional, retractable; tread 13 ft; tire size 11.00 x 12. Powerplant: two Pratt & Whitney Wasp Jr. Model B (R-985AN-14B). Propellers: Hamilton Standard Hydromatic, two-bladed; diameter 8 ft 3 in.



NOTEWORTHY FEATURES

Soundproofed cabin, hydraulic brakes and shock absorbers, blind-flying instruments. Baggage compartment 43.4 cu ft. Lands in 1460 ft and takes off in 1760 ft over 50-ft obstacle, with no wind.

BOEING Stratocruiser Model 377 T. C. 812

TYPE: Passenger, long-range; seats 60-75.

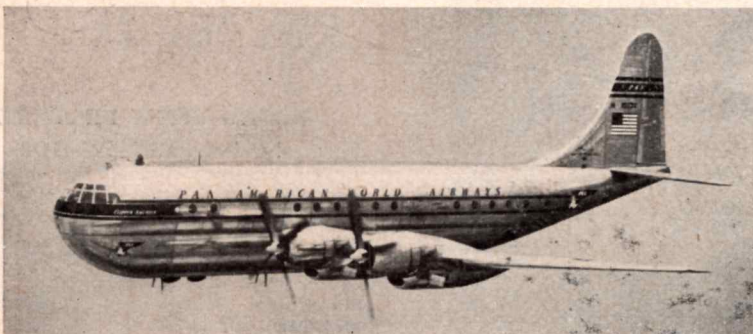
375 mph; cruising 300-340 mph; landing 93 mph. Rate of climb 1100 fpm; service ceiling 33,000 ft. Cruising range 4600 mi; fuel consumption 467 gph.

PERFORMANCE: Speed: maximum

SPECIFICATIONS: Wingspan 141 ft 3 in; length 110 ft 4 in; height 38 ft 3 in. Weight: empty 83,500 lbs; gross 142,500 lbs; power loading 10.2 lbs/hp. Fuel capacity 7790 gals. Wings: mid-wing, metal-covered aluminum spar; area 1769 sq ft; loading 80.5 psf. Fuselage: metal-covered semi-monocoque. Fabric-covered ailerons, elevator, rudder; metal-covered flaps. Landing gear: tricycle, dual wheels; oleo shock absorbers. Tire size: main 56 in. nose 36 in. Powerplant: four Pratt & Whitney Wasp Major Model B (R-4360). Propellers: Curtiss Electric or Hamilton Standard four-blade reversible.

NOTEWORTHY FEATURES

Double-deck body, pressurized and air-conditioned. Thermal anti-icing on all leading edges. Can take off from 6250-ft runway at maximum gross weight and land in 4900 ft at 130,000 lbs.



Cargo and baggage compartment 845 sq ft. Hinged fin and rudder folds down for hangaring. Interchangeable "power-pack" engine mountings permit quick change of engine, superchargers, all systems and accessories. High-density passenger version, Model B-377 *Stratocoach*, seats 103-114, has a range of 4200 mi and maximum speed of 360 mph.



BOEING Stratofreighter

Model B-367

T. C. Pending

TYPE: Cargo, long-range; payload 26 tons.

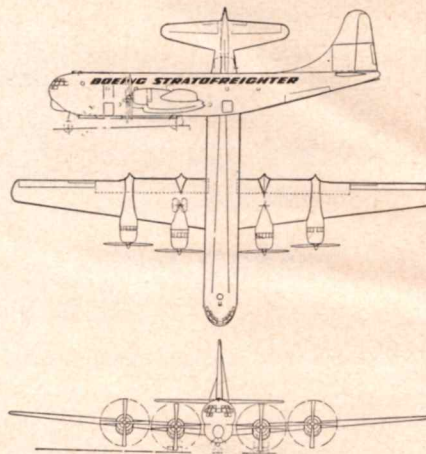
PERFORMANCE: Speed: maximum 360 mph; cruising 300-340 mph; landing 93 mph. Service ceiling 25,400 ft. Cruising range 4500 mi.

SPECIFICATIONS: Wingspan 141 ft 3 in; length 110 ft 4 in; height 38 ft 3 in. Weight: empty 77,326 lbs; gross 153,000 lbs; power loading 8.9 lbs/hp. Fuel capacity 7790 gals. Wings: mid-wing metal-covered aluminum spar; area 1769 sq ft; loading 80.5 psf. Fuselage: metal-covered semi-monocoque. Landing gear: tricycle, oleo shock absorber. Powerplant: four Pratt & Whitney Wasp Major Model C (R-4360-

C). Propellers: Hamilton Standard four-blade reversible.

NOTEWORTHY FEATURES

Commercial version of USAF Model C-97A *Stratofreighter*. Upper deck has two large doors: one under tail with integral truck ramps and hoist and one forward of wing. Lower-deck cargo compartment doors at truckbed level. Air conditioning and pressurization maintain SL conditions in all cargo and crew compartments up to 15,000 ft; cabin only, up to 25,000 ft. Cargo compartments 6470 cu ft. Built-in radome under nose section for navigational radar equipment. Maximum payload 53,000 lbs; direct operating cost 4.2 cents per ton-mile.

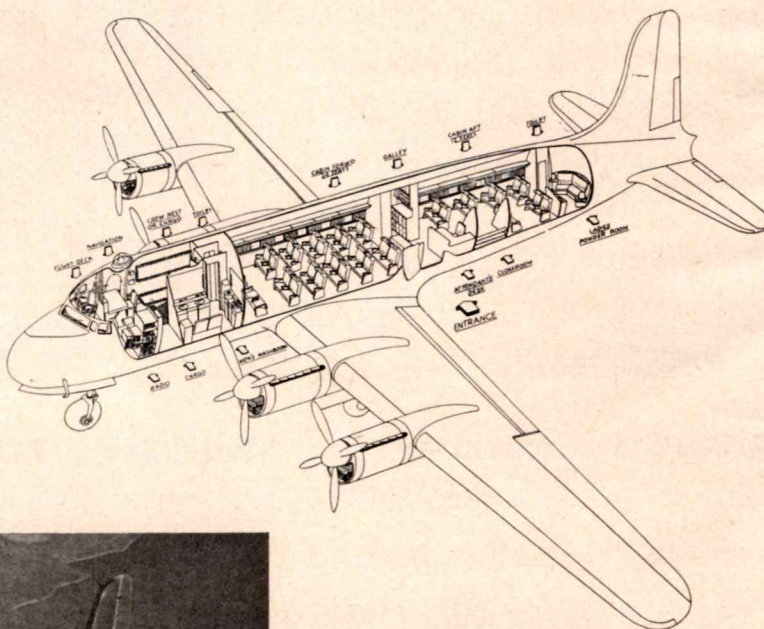


CANADAIR Model C-4 T. C. 21-4 (Canadian)

TYPE: Passenger; long range; seats 36-55.

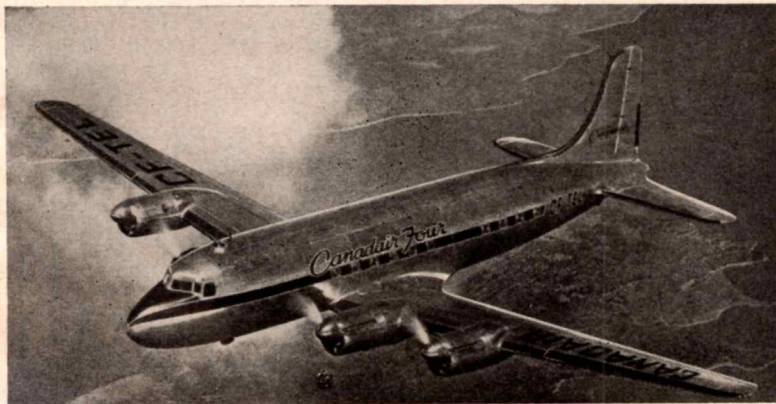
PERFORMANCE: Speed: maximum 329 mph at 20,600 ft; cruising 325 mph at 25,200 ft; landing 94 mph. Rate of climb 1240 fpm; service ceiling 29,000 ft. Maximum range 3880 mi. (All data at 70,000 lbs gross weight.)

SPECIFICATIONS: Wingspan 117 ft 6 in; length 93 ft 8 in; height 27 ft 6 in. Power loading 11.65 lbs/hp. Fuel capacity 3226 Imp gals. Wings: low; metal-covered aluminum spar; area 1457 sq ft; loading 56.3 psf. Fuselage: metal-covered semi-monocoque. Metal-covered flaps; fabric-covered ailerons, elevator, rudder. Landing gear: tricycle; oleo-pneumatic shock absorbers; tire size: main 15.50 x 20, nose 44 in. Powerplant: four liquid-cooled Rolls Royce Merlin MK 626-1 developing 1760 hp at takeoff. Propellers: Hamilton Standard three or four-blade reversible.



NOTEWORTHY FEATURES

Formerly designated DC-4M-2. Rolls Royce engines are manufactured in England and shipped to Canada for installation. Units are interchangeable and can be installed in less than an hour. Air-conditioned and pressurized cabin, with convertible sleeper accommodations. Cargo and baggage compartment 698 cu ft.



CHASE Avitruc

Model C-122C



TYPE: Cargo, troop carrier medium range; military; seats 30; payload 6 tons.

PERFORMANCE: Speed: maximum 240 mph; cruising 200 mph; landing 85 mph. Rate of climb 1340 fpm at SL;

service ceiling 29,100 ft. Cruising range 1070 mi. (All data at 32,000-lb gross weight.) Fuel consumption 100 gph.

SPECIFICATIONS: Wingspan 95 ft 8 in; length 61 ft 8 in; height 24 ft 8 in. Weight: empty 19,000 lbs; gross

40,000 lbs; power loading 11.2 lbs/hp. Fuel capacity 1300 gals. Wings: high; metal-covered aluminum spar; loading 39.4 psf. Fabric-covered ailerons, elevator, rudder; all-metal flaps. Landing gear: tricycle; tire size: main 17.00 x 16, nose 24-7; brakes Goodyear PD-377. Electrical system: 24 v, 300 a unit generator capacity. Powerplant: Wright Cyclone 9 (R-1820-101).

NOTEWORTHY FEATURES

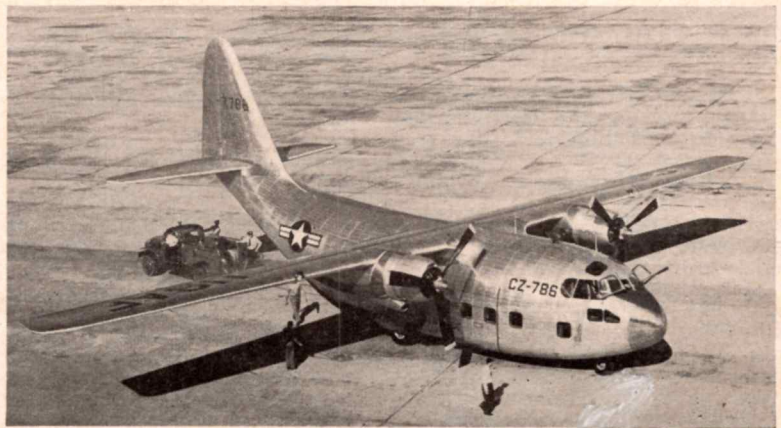
Designed as assault-troop and cargo transport to operate on short fields and in rough terrain. Cargo-compartment floor 30 in from ground level, facilitating loading. Provision for carrying 24 litter patients, 2 medical attendants and supplies. Can carry 30 fully-equipped troops.

CHASE Avitruc Model XC-123

TYPE: Cargo; medium range; military; seats 60, payload 9 tons.

PERFORMANCE: Speed: maximum 245 mph; cruising 215 mph; landing 85 mph. Rate of climb 1250 fpm; service ceiling 29,000 ft. Cruising range 1160 mi. (All data at 49,000-lbs gross weight.) Fuel consumption 120 gph.

SPECIFICATIONS: Wingspan 110 ft; length 77 ft 1 in; height 32 ft 8 in. Weight: empty 25,000 lbs; gross 54,000 lbs; power loading 12 lbs/hp. Fuel capacity 1340 gals. Wings: high; metal-covered aluminum spar; loading 39.4 psf. Fabric-covered ailerons, elevator, rudder; all-metal flaps. Landing gear: tricycle; tire size: main 17.00 x 20, nose 11.00 x 12; brakes Goodyear hydraulic. Electrical system: 24 v,



200 a unit generator capacity. Powerplant: Pratt & Whitney Double Wasp Model CB (R-2800-CB14).

NOTEWORTHY FEATURES

Designed and built for sole purpose of cargo transport. Jettisonable, self-sealing fuel tanks. Chase loading ramp located in rear of fuselage for wheeled

vehicles. Can be converted into troop or evacuation transport, accommodating 60 fully-equipped troops or 50 litter and 6 ambulatory patients plus 6 medical attendants. Designed to operate as glider either with or without engine nacelles and has tow release mechanism in both nose and tail. Can tow gliders up to 30,000 lbs.



CONVAIR Liner

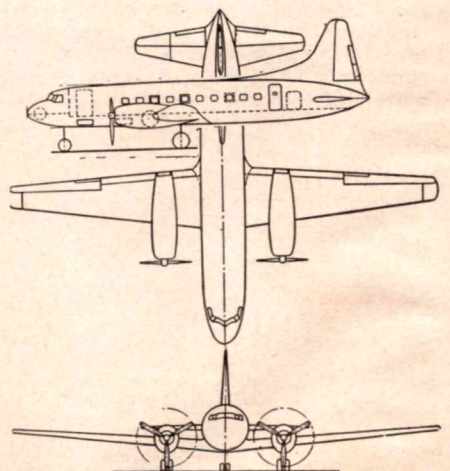
Model CVAC-240

T. C. 793

TYPE: Passenger, medium range; seats 40.

PERFORMANCE: Speed: maximum 313 mph; cruising 286 mph; landing 99 mph. Rate of climb 1430 fpm; service ceiling 25,500 ft. Cruising range 910 mi. Fuel consumption 216 gph.

SPECIFICATIONS: Wingspan 91 ft 9 in; length 74 ft 8 in; height 26 ft 11 in. Weight: empty 26,100 lbs; gross 41,200 lbs; power loading: 8.6 lbs/hp. Fuel capacity 1000 gals. Wings: low; metal-covered aluminum spar; area 817 sq ft; loading 51.5 psf; control surface area 402 sq ft. Fuselage: metal-cov-



ered semi-monocoque. Metal-covered ailerons, elevator, rudder, flaps. Landing gear: tricycle; tire size: main 9.90 x 34, nose 26 x 6; shock absorber;

oleo pneumatic. Radio: Collins or Bendix. Battery: Exide. Powerplant: Pratt & Whitney Double Wasp Model CA (R-2800-CA-18). Propeller Hamilton Standard or Curtiss Electric, 3-blade, automatic feathering, reversible.

NOTEWORTHY FEATURES

Only twin-engine pressurized transport in production. Jet-exhaust augmentation adds about 10 mph speed and cools engines. Hydraulically-operated, self-contained passenger ramp in door forward of wing. Equipped with thermal anti-icing system. Cargo compartment 281 cu ft; baggage compartment 154 cu ft. Now being used as airline replacement for Douglas DC-3.



de HAVILLAND Beaver Model DHC-2

TYPE: Passenger, cargo; short-range, feeder; seats 7.

PERFORMANCE: Speed: maximum 171 mph; cruising 153 mph; landing 42 mph. Rate of climb 1290 fpm; service ceiling 26,000 ft. Cruising range 578 mi. Fuel consumption 16.5 gph.

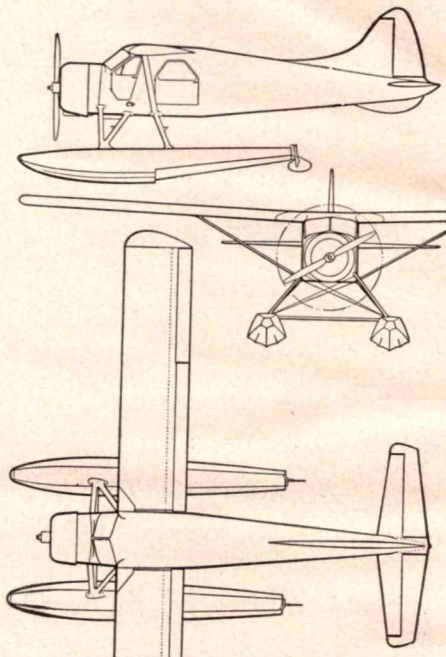
SPECIFICATIONS: Wingspan 48 ft; length 30 ft 3 in; height 10 ft 7 in. Weight: empty 2775 lbs; gross 4650 lbs; power loading 10.3 lbs/hp. Fuel capacity 72 Imp gals. Wings: high; metal-covered aluminum spar; area 250 sq ft; loading 18.6 psf. Fuselage: metal-covered semi-monocoque. Metal-covered ailerons, elevator, rudder, flaps. Landing gear; conventional, rubber-block shock absorbers; tire size: main 7.50 x 10; tail 5.00 x 4. Radio:

Lear. Battery: Exide. Lighting equipment: Grimes. Powerplant: Pratt & Whitney Wasp Jr. Model B (R-985-AN6B); Propeller: Hamilton Standard 6101A-18.

PRICE: \$26,450 (FAF standard equipment).

NOTEWORTHY FEATURES

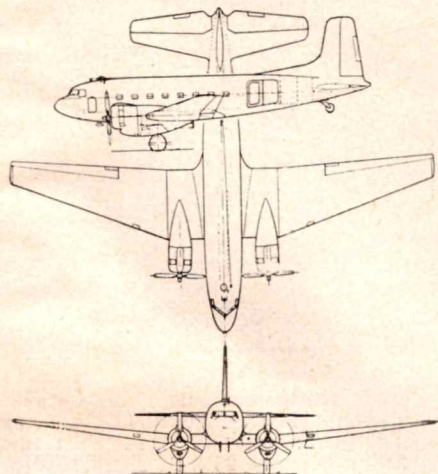
Especially designed for Canadian "bush-country" operation upon recommendations by commercial pilots in that area. Certificated for floats and skis. Takeoff run: seaplane 775 ft; landplane 550 ft with full load, no wind. Completely winterized for arctic operation. Reinforced cabin flooring and equipped with canoe carriers on float models. Cargo and baggage compartments 124 cu ft.



DOUGLAS Super DC-3

TYPE: Passenger, cargo, medium-range; seats 31.

PERFORMANCE: Speed: maximum 270 mph; cruising 242 mph; landing 77 mph. Rate of climb 1300 fpm; service ceiling 22,100 ft. Cruising range 1425 mi at max. cruise power. Fuel consumption: 407 gph at max. range power; 800 gph at max. cruise power.



Model 1189A T. C. Pending



SPECIFICATIONS: Wingspan 90 ft; length 67 ft 9 in; height 18 ft 3 in. Weight: empty 20,091 lbs; gross 31,000 lbs; power loading 10.5 lbs/hp. Fuel capacity 822 gals. Wings: low; metal-covered aluminum spar; area 969 sq ft; loading 32 psf. Fuselage: metal-covered semi-monocoque. Fabric-covered ailerons; elevator rudder; metal-covered flaps. Landing gear: conventional; shock absorber: oleo-pneumatic; tire

size: main 17.00 x 16, tail 9.00 x 6. Powerplant: two Wright Cyclone 9 (R-1820-C9HE). Propeller: Hamilton Standard full-feathering 1-3417A.

NOTEWORTHY FEATURES

Rear bulkhead moved 40 in aft and fuselage lengthened 39 in to enlarge cabin by 6 ft 7 in. New empennage, outer wing panels give greater longitudinal stability. New heating system;

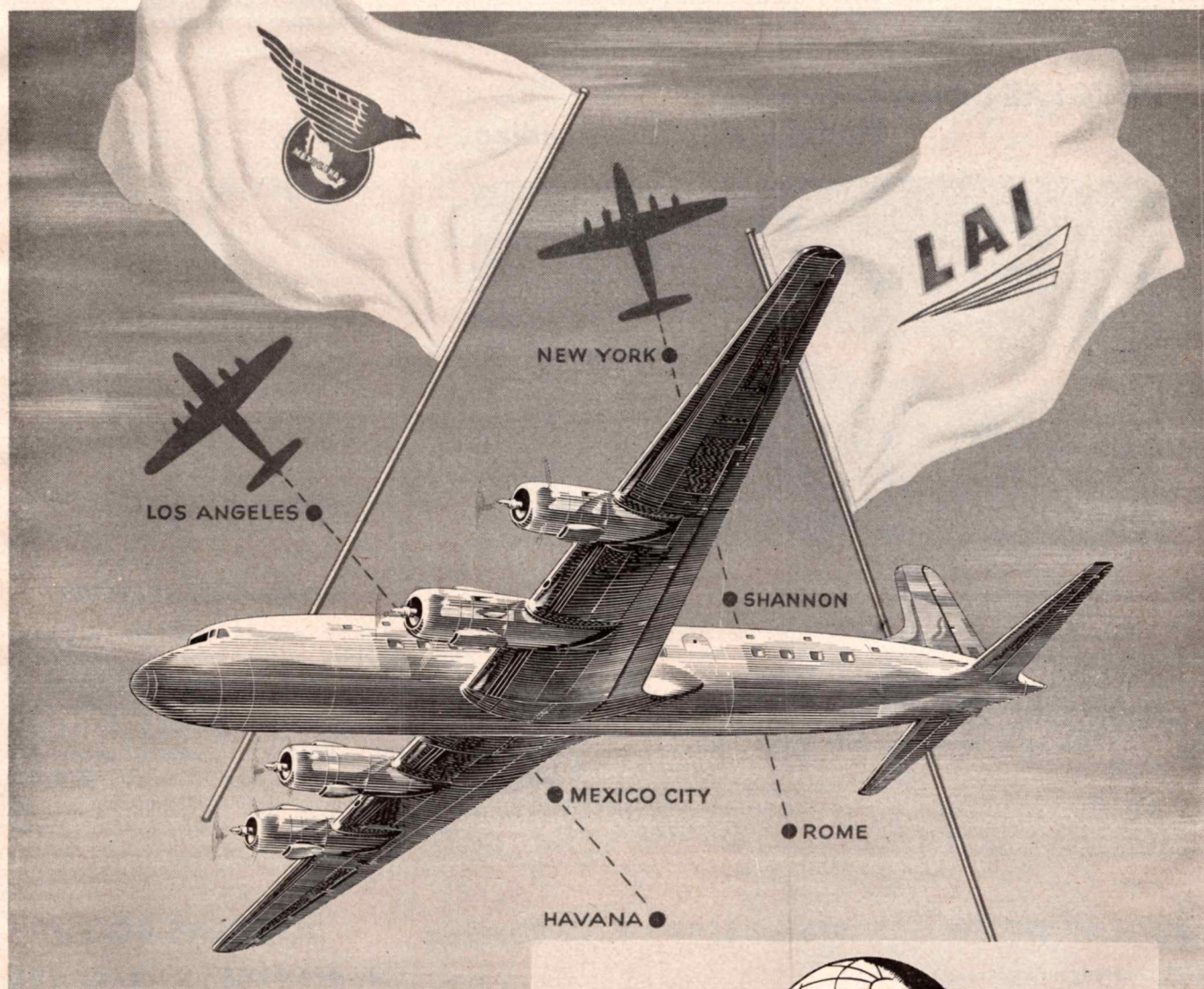
Two more airlines... join the great DC-6 parade!

Latest airlines to order Douglas DC-6 transports are Compania Mexicana de Aviacion (C.M.A.) and Lines Aeree Italiane (L.A.I.).

As the DC-6 enters the service of these progressive, international airlines, it will bring to their customers the fastest, most comfortable, most luxurious accommodations for travel by air available in the world today.

A total of 185 DC-6s have now been delivered or are on order—assuring continuous operation of the DC-6 production line well into 1951. Thus Douglas enters its fourth decade devoted to the creation of the finest in fast, *dependable* aircraft.

DOUGLAS AIRCRAFT COMPANY, INC., SANTA MONICA, CALIFORNIA



DEPEND ON DOUGLAS

30th ANNIVERSARY YEAR



(Continued from page 70)
new main landing gear fully retractable into nacelles; tailwheel also retractable. Self-contained stairway integral with passenger door on port side of fuselage. Cargo compartment 290 cu ft; baggage

compartment 270 cu ft. Large cargo door similar to C-47 on port side of fuselage. Seat-mile cost lowered to 01.16 cents. Customer required to furnish DC-3 airplane, radio equipment and extra seats; conversion and mod-

ernization done at Douglas plant. Alternate powerplant: Pratt & Whitney Twin Wasp Model D (R-2000-D7) increases cruising range to 1530 mi; decreases gross weight, fuel consumption and rate of climb.

DOUGLAS DC-6

Model 1159 T. C. 781

TYPE: Passenger, long-range trans-oceanic; seats 48.

PERFORMANCE: Speed: maximum 356 mph; cruising 307 mph; landing 91 mph. Rate of climb 1100 fpm; service ceiling 28,500 ft. Cruising range 4610 mi. Fuel consumption 245-398 gph.

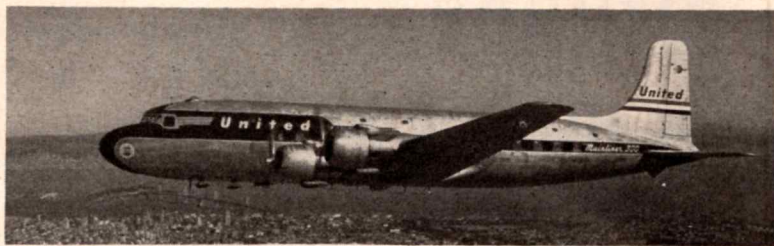
SPECIFICATIONS: Wingspan 117 ft 6 in; length 100 ft 7 in; height 28 ft 5 in. Weight: empty 53,623 lbs; 97,200

lbs; power loading 10.1 lbs/hp. Fuel capacity 4248-4700 gals. Wings: area 1463 sq ft; loading 66.4 psf. Powerplant: four Pratt & Whitney Double Wasp Model CA (R-2800-CA-15). Propellers: Hamilton Standard, full-feathering, reversible, three 2H17K3-48R

blades. Other data same as Model 1156.

NOTEWORTHY FEATURES

Same as Model 1156 except with larger galley, over-water safety equipment and sleeper accommodations. Cargo and baggage compartment 464 cu ft.



DOUGLAS DC-6A Liftmaster

Model 1135 T. C. Pending

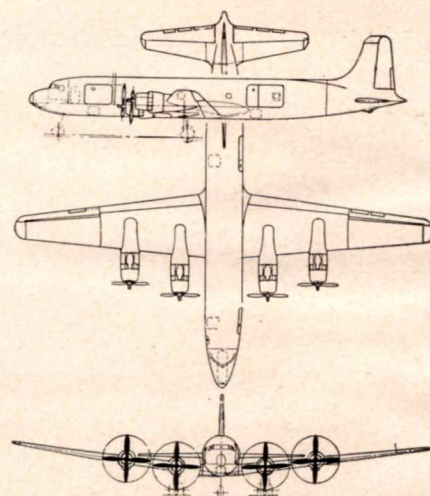


TYPE: Cargo, long-range; payload 14 tons.

PERFORMANCE: Speed: maximum 364 mph; cruising 316 mph; landing 94 mph. Rate of climb 1130 fpm; service ceiling 27,000 ft. Cruising range 4540 mi. Fuel consumption 593-757 gph.

SPECIFICATIONS: Wingspan 117 ft 6 in; length 105 ft 7 in; height 28 ft 8 in. Weight: empty 49,767 lbs; gross

100,000 lbs; power loading 10 lbs/hp. Fuel capacity 3322-4700 gals. Wings: low; metal-covered aluminum spar; area 1463 sq ft; loading 68.4 psf. Fuselage: metal-covered semi-monocoque. Metal-covered ailerons, elevator, flaps; fabric-covered rudder. Landing gear: tricycle. Shock absorbers oleo-pneumatic. Tire size: main 17.00 x 20, nose 44 in. Powerplant: Pratt & Whitney Double Wasp Model CB (R-2800-CB17). Propeller: Hamilton Standard reversible, full-feathering, four 2H17K3-48R blades.



NOTEWORTHY FEATURES

Automatically air-conditioned and pressurized. Constant-section cabin with cargo doors both forward and aft on port side of fuselage. First commercial transport designed specifically for cargo. Electrically-operated power lift integral with 78 x 124-in after door has a capacity of 4000 lbs and can be used at forward door as well. Cargo compartment 5000 cu ft.

DOUGLAS DC-6B

Model 1198 T. C. Pending

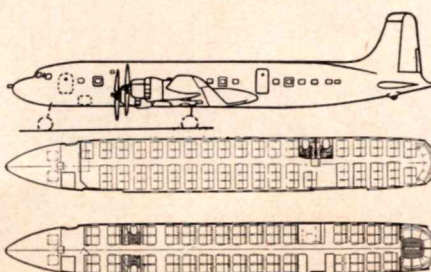
TYPE: Passenger, long-range; seats 64.

PERFORMANCE: Same as DC-6A.

SPECIFICATIONS: Same as DC-6A except weight—empty 53,517 lbs.

NOTEWORTHY FEATURES

Passenger version of Model 1135. Luxury interior identical to DC-6, with addition of 8 seats. High-density version seats 92 passengers. Cargo compartment 502 cu ft. No cargo doors.



DOUGLAS DC-6

Model 1156 T. C. 781

TYPE: Passenger, long-range domestic; seats 56.

PERFORMANCE: Speed: maximum 358 mph; cruising 309 mph; landing 87.5 mph. Rate of climb 1260 fpm; service ceiling 27,000 ft. Cruising range 4780 mi. Fuel consumption 233-398 gph.

(Continued on opposite page)

(Continued from opposite page)

SPECIFICATIONS: Wingspan 117 ft 6 in; length 100 ft 7 in; height 28 ft 5 in. Weight: empty 51,458 lbs; gross 91,300 lbs; power loading 10.9 lbs/hp. Fuel capacity 3322-4700 gals. Wings: low; metal-covered aluminum spar; area 1463 sq ft; loading 62.4 psf. Fuselage: metal-covered semi-monocoque. Metal-covered ailerons, rudder, flaps; fabric-covered rudder. Landing gear: tricycle. Shock-absorber: oleo-pneumatic. Tire size: main 17.00 x 20, nose 44 in. Powerplant: four Pratt & Whitney Double Wasp Model CA (R-2800-CA15). Propellers: Curtiss Electric reversible, full-feathering; three No. 744 blades.

NOTEWORTHY FEATURES

Automatically controlled cabin air conditioning and pressurization, maintaining constant temperature and 8000-ft atmosphere up to 20,000 ft altitude. Semi-circular rear lounge with observation windows and built-in tables. All leading edges equipped with thermal anti-icing system. Aerodynamic boost on control system permits direct manual operation with minimum effort. Baggage and cargo compartment 541 cu ft.



DOUGLAS Globemaster II

TYPE: Cargo: troop carrier; long-range, military.

PERFORMANCE: Restricted.

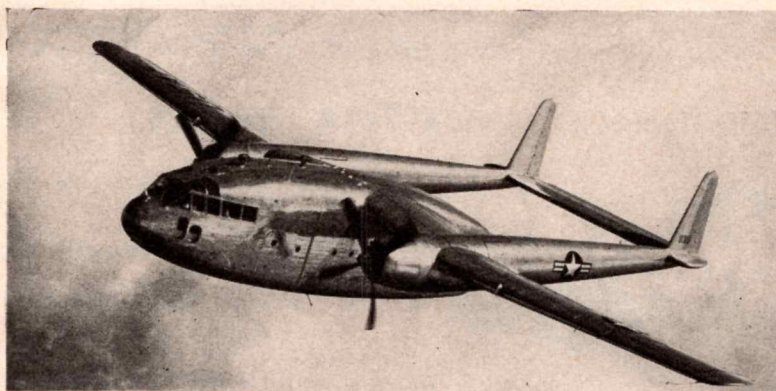
SPECIFICATIONS: Wingspan 173 ft 3 in; length 127 ft 1 in; height 48 ft 4 in. Weight: empty 95,707 lbs; gross 175,000 lbs; power loading 12.5 lbs/hp. Fuel capacity 11,000 gals. Wings: low; metal-covered aluminum spar; loading 69.7 psf. Fuselage: metal-covered. All-metal elevator, flaps; fabric-covered ailerons, rudder. Landing gear: tricycle. Tire size: main 25.00 x 28, nose 15.51 x 20. Brakes: Goodrich expander tube. Electrical system: 28 v, 1200 a. Powerplant: four Pratt & Whitney Wasp Major Model B (R-4360-20W).

NOTEWORTHY FEATURES

USAF Model C-124A. Largest production transport in military service. Designed to carry troops, general cargo and such military equipment as tanks, field guns, construction machinery and fully-loaded trucks. Can fly a 50,000-lb payload on a 2000-mi round-trip with a crew of 5, without refueling. Clamshell doors in nose provide opening over 11 ft square and a built-in ramp permits vehicles to be rolled or driven into 10,000-cu ft cargo compartment. Electrically operated cargo elevator installed in center of cargo compartment. Interior can be converted into double-deck cabin accommodating 200 fully-equipped troops.

FAIRCHILD Packet

Model C-119



TYPE: Troop, cargo carrier; long-range; military; payload 10 tons.

PERFORMANCE: Speed: maximum 266 mph; landing speed 92 mph. Rate of climb 1140 fpm; service ceiling 21,200 ft. Cruising range 2925 mi.

SPECIFICATIONS: Wingspan 109 ft 3 in; length 85 ft 5 in; height 26 ft 6 in. Weight: empty 38,329 lbs; gross 71,800 lbs; power loading 11.05 lbs/hp. Fuel capacity 2798 gals. Wings: high; metal-covered aluminum spar; loading 49.6 psf. Fuselage: metal-covered.

Fabric-covered ailerons, elevator, rudder, flaps. Landing gear: tricycle. Tire size: main 15.50 x 20, nose 44 in. Brakes: Bendix 4-rotor disc. Electrical system: 24 v, 600 a. Powerplant: two Pratt & Whitney Wasp Major Model B (R-4360-20W).

NOTEWORTHY FEATURES

USN Model R4Q. Development of Model C-82, which it is replacing as standard USAF troop-carrier aircraft. Cargo compartment over 2800 cu ft. Can carry 42 fully-equipped troops plus 20 500-lb paracans of supplies. Loading doors in rear with integral jump doors for paratroop exit. Paracans may be dropped in flight through doors in floor of forward cargo hold, which features truck bed-level loading. Has a military operational range of 2000 nautical miles with full load without refueling and has provisions for glider tow. First production models in use at Smyrna AFB, Tenn.

GRUMMAN Mallard

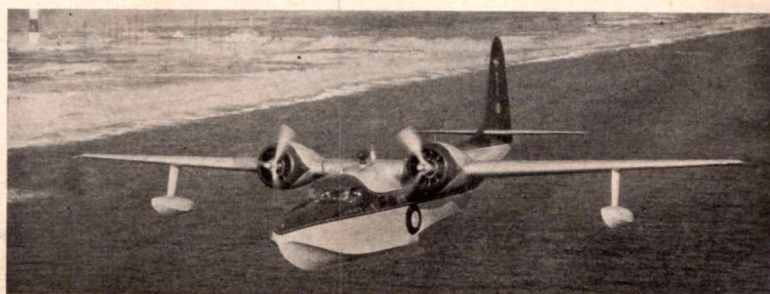
Model G-73

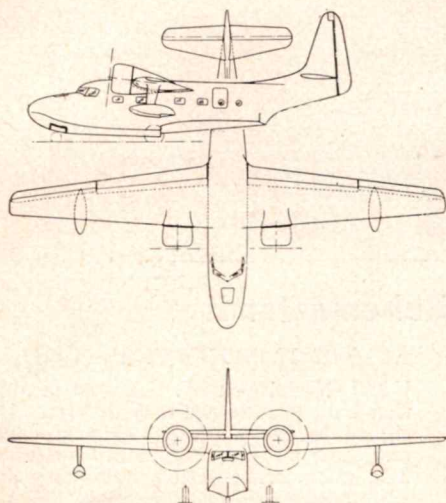
T.C. 783

TYPE: Amphibian; executive, feeder; seats 10-12.

PERFORMANCE: Speed: maximum 215 mph; cruising 180 mph; landing 71 mph. Rate of climb 1290 fpm; service ceiling 23,000 ft. Cruising range 730 mi; max. range 1100 mi at 8000 ft. Fuel consumption 52 gph.

SPECIFICATIONS: Wingspan 66 ft 8 in; length 48 ft 4 in; height 18 ft 9 in. Weight empty 9350 lbs; gross 12,750





lbs; power loading 10.6 lbs/hp. Wings: high; metal-covered aluminum spar; area 444 sq ft; loading 28.7 psf. Fuselage: 2-step all-metal monocoque, with metal covering. Metal-covered elevator, flaps; fabric-covered ailerons, rudder. Landing gear: single hull, wingtip floats; amphibious gear: tricycle. Shock absorber Bendix oleo. Tire size: main 9.60 x 16, nose 19 x 6.8. Electrical system 12 v. Powerplant: two Pratt & Whitney Wasp Model S3H-1 (R-1340). Propeller: Hamilton Standard Hydromatic full-feathering, Model 23D-40 with 6533-18 blades; diameter 8 ft 7 in. PRICE: \$150,000 (FAF standard equipment).

NOTEWORTHY FEATURES

First amphibian to have passed CAA qualification tests for "Scheduled Air

Carrier Operations" rating. Post-war development of Grumman Widgeon. Automatic air-conditioning, cabin upholstered, carpeted and soundproofed with indirect fluorescent lighting, built-

in smoking stands and refreshment cabinet. Interior versions vary as to use: executive, passenger or cargo transport, pleasure. 50-gal auxiliary fuel tanks in wingtip floats are optional.



LOCKHEED Constellation Model 89

TYPE: Passenger: troop carrier; long-range; military; seats 168.

PERFORMANCE: Speed: maximum 303 mph at 20,000 ft; cruising 286 mph at 25,000 ft; landing 80 mph. Maximum range 6300 mi. Service ceiling 27,600 ft. Takeoff and landing distance 2350 ft.

SPECIFICATIONS: Wingspan 189 ft 1 in; length 156 ft 1 in; height 50 ft 4 in. Weight: empty 114,575 lbs; gross 184,000 lbs. Fuel capacity 9780 gals. Wings: low midwing; metal-covered. Fuselage: twin-deck, metal-covered semi-monocoque. Metal-covered ailerons, elevator, rudder, flaps. Landing gear: tricycle. Main gear 8-wheel; steerable nose wheel. Powerplant: four

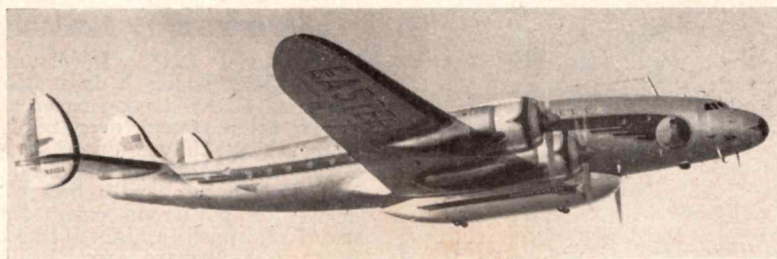
Pratt & Whitney Wasp Major TSBI-G (R-4360). Propellers: Curtiss Electric four-blade, reversible; diameter 19 ft 2 in.

NOTEWORTHY FEATURES

USN Model XR60-1. Hydraulic power boost surface control with two standby systems. Lockheed-Fowler wing flaps. Complete thermal anti-icing system with electric windshield anti-icers. Mechanical, electrical and hydraulic systems can be serviced in flight; engine nacelles accessible for in-flight maintenance. Automatic air-conditioning and cabin pressurization maintaining 10,000-ft atmosphere up to 25,000 ft. Upper-deck capacity 92 passengers; lower-deck cargo and baggage capacity 7375 cu ft. Crew of 9 plus 3 relief.

LOCKHEED Constellation

Model 749A T. C. 763



TYPE: Passenger: long-range; seats 50-64.

PERFORMANCE: speed: maximum 350 mph; cruising 320 mph; landing 91 mph. Service ceiling 24,000 ft. Cruising range 4600 mi.

SPECIFICATIONS: Wingspan 123 ft; length 95 ft 3 in; height 18 ft 8 in.

Weight: empty 60,000 lbs; gross 107,000 lbs. Fuel capacity 5820 gals. Wings: low; metal-covered aluminum spar; area 1650 sq ft. Fuselage: metal-covered semi-monocoque. Fabric-covered rudder; metal-covered ailerons, elevator, flaps. Landing gear: tricycle. Shock absorber oleo-pneumatic. Tire size: main 17.00 x 20, nose 9.90 x 34; tread 28 ft. Brakes Bendix. Power-

plant: four Wright Cyclone 18 Model C18BD-1 (R-3350-35). Propellers: Curtiss Electric or Hamilton Standard Hydromatic, 3-blade reversible.

NOTEWORTHY FEATURES

USAF Model C-121A. Similar to earlier Model 649 with addition of integral fuel tanks in outer wing panels, new main landing-gear struts and brakes, reinforced wing and fuselage. Provisions for installation of Speedpak for short and medium ranges, adding 400 cu ft additional cargo space to standard 434 cu ft. Automatic cabin pressurization and air-conditioning, maintaining 8000-ft atmosphere at 20,000 ft altitude. Hydraulic power-boost surface controls; Lockheed-Fowler wing flaps. Capacity, lower cargo compartments 13,500 lbs; Speedpak 8000 lbs.

MARTIN

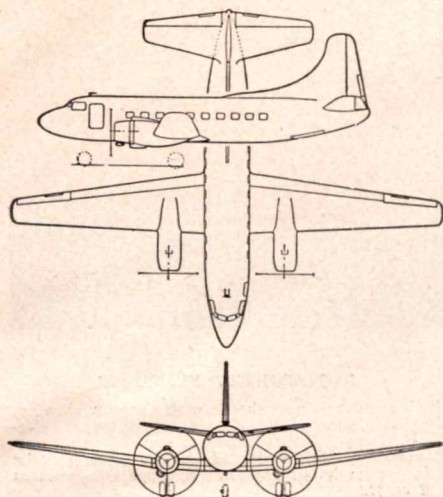
Model 2-0-2

T. C. A-795

TYPE: Passenger: medium-range; seats 36.

PERFORMANCE: Speed: maximum 312 mph; cruising 286 mph; landing 86 mph. Rate of climb 1790 fpm; service ceiling 27,300 ft. Operational range 1380 mi. Fuel consumption 170 gph.





NORTHROP Raider

TYPE: Assault cargo-and-troop carrier; arctic rescue; medium-range; military; seats 32.

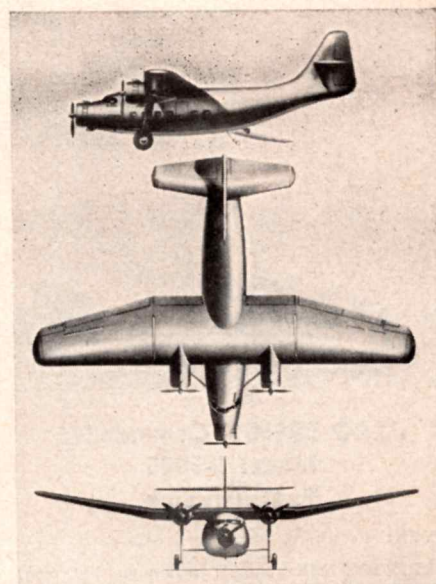
PERFORMANCE: Speed max. cruising 201 mph; econ. cruising speed 169 mph. Rate of climb 1155 fpm; service ceiling 15,200 ft at 36,000 lbs. Max. cruising range 2080 mi.

SPECIFICATIONS: Wingspan 86 ft 6 in.; length 67 ft 1 in.; height 23 ft 2 in. Weight: empty 26,690 lbs; gross 38,000 lbs; power loading 10.5 lbs/bhp. Wings: high; metal-covered aluminum spar; loading 33.5 psf. Fuselage: metal-covered semi-monocoque. Metal-covered ailerons, elevator, rudder, full-span flaps. Landing gear: conventional fixed, wide-tread. Tire size: main 45 in, tail 25 in; brakes Goodyear single-disc. Electrical system 24 v. Powerplant: three Wright Cyclone 9 (R-1820-

SPECIFICATIONS: Wingspan 93 ft 3 in.; length 74 ft 7 in.; height 28 ft 5 in. Weight: empty 26,211 lbs; gross 42,750 lbs; power loading 8.9 lbs/hp. Fuel capacity 1350 gals. Wings: low; metal-covered aluminum spar; area 864 sq ft; loading 49.5 psf. Fuselage: metal-covered semi-monocoque. Metal-covered ailerons, elevator, flaps; fabric-covered rudder. Landing gear: tri-cycle; shock absorber oleo; tire size: main 12.50 x 16, nose 9.50 x 16. Powerplant: two Pratt & Whitney Double Wasp Model CB (R-2800-CB16). Propellers: Hamilton Standard Model 2H17K3-48R.

NOTEWORTHY FEATURES

Under-wing refueling provision; pilot-designed cockpit. Synthetic rubber fuel cells in outer wing panels. Hydraulically operated integral tail ramp. Thermal anti-icing system. Cargo and baggage compartment 346 cu ft. Aircraft presently being used by Northwest Airlines and Linea Aeropostal Venezolana.



Model C-125



99). Propellers: Hamilton Standard Hydromatic, three-blade, reversible, Model 23260.

NOTEWORTHY FEATURES

Military version of Pioneer Model N-23 prototype. Designed for operation in rugged terrain and for maintenance

with facilities at a minimum. Additional wheel can be installed on main gear for soft-earth landings. Rear ramp door permits in-line loading of vehicles and cargo. Can carry military vehicles with double axle loads of 8000 lbs or 32 fully-equipped troops. Canadair has been licensed to manufacture Raider for export.

AIR MEETINGS AND EVENTS

March

- 1-2—Louisiana Aviation Conference. Washington-Youree Hotel, Shreveport, La.
- 6-9—American Road Builders Assn. Annual Meeting (including Airport Division). Netherlands Plaza Hotel, Cincinnati, Ohio
- 6-9—Institute of Radio Engineers. Annual Convention. Hotel Commodore and Grand Central Palace, New York
- 18—National Model Plane Exhibit Contest. Higbee Co. Auditorium, Cleveland, Ohio
- 24—Institute of the Aeronautical Sciences. 5th Annual Flight Propulsion Meeting. Hotel Carter, Cleveland, Ohio
- 28-31—Fourth National Plastics Exposition. Sponsored by the Society of the Plastics Industry. Navy Pier, Chicago, Ill.
- 28-31—New York's 20th Annual Safety Convention and Exposition. Sponsored by

the Greater New York Safety Council. Statler and Governor Clinton Hotels, New York City

- 30-31—American Helicopter Society Annual Forum. Ben. Franklin Hotel, Philadelphia

April

- 4-6—Air Transport Assn. Annual Engineering and Maintenance Conference. Hotel Continental, Kansas City, Mo.
- 4-6—National Production Exposition. Sponsored by the Chicago Technical Societies Council. Steven Hotel, Chicago
- 10-12—American Society of Lubrication Engineers. 5th Annual Convention and 3rd Annual Lubrication Exhibit. Hotel Statler, Detroit
- 10-14—American Society of Tool Engineers Exposition. Convention Hall, Phila.

- 16-20—22d Annual Business Meeting of the American Assn. of Airport Executives. Neil House Hotel, Columbus, Ohio

- 17-19—Society of Automotive Engineers Aeronautical Meeting and Aircraft Engineering Display. Hotel Statler, New York

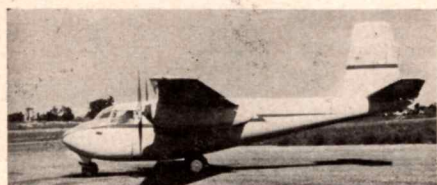
- 24-26—Airport Operators Council. 3rd Annual Meeting. Hotel Carter, Cleveland, Ohio

May

- 5-6—Midwestern Conference on Fluid Dynamics and National Meeting of the American Physical Society, Fluid Dynamics Section. University of Illinois, Urbana, Ill.

- 28-(through June 4)—Federation Aeronautique Internationale Conference. Stockholm. (Continued on page 132)

1950 Annual Directory of PERSONAL AIRCRAFT



AERO DESIGN Commander
Model L-3805
T. C. Pending

TYPE: Passenger, executive five-place.

PERFORMANCE: Speed: maximum 190 mph; cruising 175 mph; landing 57 mph. Rate of climb 1250 fpm; service ceiling 22,000 ft. Fuel consumption 20 gph.

SPECIFICATIONS: Wingspan 44 ft; length 32 ft; height 12 ft. Weight: empty 2800 lbs; gross 4600 lbs; power loading 12 lbs/hp. Wing: high; metal-covered semi-monocoque. Metal-covered ailerons, elevator, rudder, flaps. Landing gear: tricycle; tire size: main 7.50 x 10, nose 6.00 x 6. Electrical system 12 v. Powerplant: two Lycoming O-435-A. Propellers: optional.

PRICE: \$30,000 (approx. FAF standard equipment).

NOTEWORTHY FEATURES

Designed for executive, feeder and charter operation furnishing airline-type equipment at economical initial and operational cost. Excellent all-around performance claimed.



ANDERSON, GREENWOOD
Model AG-14
T. C. Pending

TYPE: Passenger: two-place side-by-side.

PERFORMANCE: Speed: maximum over 120 mph; cruising over 110 mph. Rate of climb over 700 fpm; service ceiling over 19,000 ft. Cruising range 400 mi.

SPECIFICATIONS: Wingspan 34 ft; length 22 ft 7 in; height 7 ft. Weight: empty 850 lbs; gross 1400 lbs; power loading 15.5 lbs/hp. Fuel capacity 23 gals. Wings: midwing; metal-covered aluminum spar, hinged trailing edge; area 120 sq ft; loading 11.7 psf. Fuselage all-metal semi-monocoque; all-metal tail booms. Metal-covered ailerons, elevator, rudder, flaps. Landing gear: fixed tricycle, oleo shock absorber; tire size: main 6 x 6, nose 5 x 4. GE radio, Reading battery; Grimes lighting equipment. Powerplant: Continental C-90-8F, pusher installation. Propeller: Hartzell adjustable.

NOTEWORTHY FEATURES

Wide field of vision, spin-resistant, steerable nose-wheel. Fuel tanks in leading edge of center section. Baggage compartment 9 cu ft. Dual controls with rudder pedals on left side only. Large wide doors with low sills, soundproofed cabin.

AERO-FLIGHT Streak 85 Model NC-1

TYPE: Passenger; two-place.

PERFORMANCE: Speed: maximum 175 mph; cruising 165 mph; landing 52 mph. Rate of climb 950 fpm; service ceiling 17,000 ft. Cruising range 750 mi. Fuel consumption 3-6 gph.

SPECIFICATIONS: Wingspan 25 ft 3 in; length 21 ft 2 in; height 8 ft 3 in. Weight: empty 850 lbs; gross 1400 lbs. Fuel capacity 25 gals. Wings: low; metal-covered aluminum spar; detachable tips. Fuselage: metal-covered semi-monocoque, flush-riveted. Metal-covered ailerons, elevator, rudder, slotted flaps. Landing gear: tricycle, retractable; shock absorber oleo-pneumatic; tire size: main 5x4, nose 5 x 4. Hallicrafter radio, Willard battery, Grimes lighting equipment. Powerplant: Continental C-85-12J. Propeller: Sensenich constant-speed.

AERO-FLIGHT Streak-165 Model NC-3

TYPE: Passenger: two-place.

PERFORMANCE: Speed: maximum 219 mph; cruising 210 mph; landing 57 mph. Rate of climb 2000 fpm; service ceiling 25,500 ft. Cruising range 1060 mi. Fuel consumption 6-10 gph.

SPECIFICATIONS: Wingspan 25 ft 3 in; length 22 ft 4 in; height 8 ft 3 in. Weight: empty 1045 lbs; gross 1695 lbs. Fuel capacity 40 gals. Powerplant: Franklin 335 Model 6A4-165-B3.

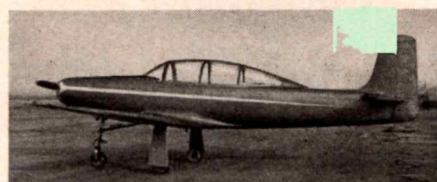
NOTEWORTHY FEATURES

Identical with Model NC-1 except for powerplant



NOTEWORTHY FEATURES

Full-swiveling nosewheel with shimmy-damper. Design gliding speed 270 mph. Sliding bubble-type canopy. Control surfaces statically and aerodynamically balanced; adjustable elevator trim tabs. Soundproof cockpit. Baggage compartment 8.2 cu ft.



and consequent change in length, weight, fuel capacity and tire size. Claimed to be world's fastest personal aircraft.

AERO-FLIGHT Streak-125 Model NC-2

TYPE: Passenger: two-place.

PERFORMANCE: Speed: maximum 202 mph; cruising 192 mph; landing 54 mph. Rate of climb 1500 fpm; service ceiling 20,500 ft. Cruising range 850 mi. Fuel consumption 5-10 gph.

SPECIFICATIONS: Wingspan 25 ft 3 in; length 28 ft 4 in; height 8 ft 3 in. Weight: empty 955

lbs; gross 1560 lbs. Fuel capacity 30 gals. Landing gear: tire size 5 x 5. Powerplant: Continental C-125-2.

NOTEWORTHY FEATURES

Identical with Model NC-1 except for powerplant and consequent change in length, weight, fuel capacity and tire size. Prototype illustrated.

AERONCA Sedan Model 15AC T. C. 802

TYPE: Passenger, executive; four-place.

PERFORMANCE: Speed: maximum 129 mph; cruising 114 mph; landing 53 mph. Rate of climb 800 fpm; service ceiling 12,400 ft. Cruising range 456 mi. Fuel consumption 9 gph.

SPECIFICATIONS: Wingspan 37 ft 6 in; length 25 ft 3 in; height 7 ft. Weight: empty 1150 lbs; gross 2050 lbs; power loading 14.1 lbs/hp. Fuel capacity 36 gals. Wings: high; metal-covered aluminum spar; area 200 sq ft; loading 10.25 psf. Control surface area 43.8 sq ft. Fuselage: fabric-covered steel tube. Fabric-covered



wooden or McCauley Model DM7649 metal. Bendix radio, Willard battery.

PRICE: \$4848 (FAF standard equipment).

NOTEWORTHY FEATURES

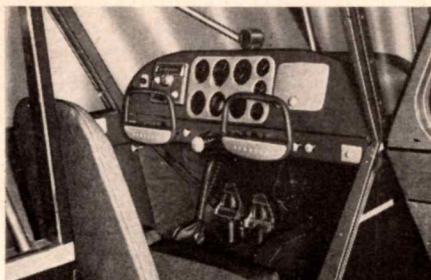
Dual controls, cabin heating, soundproofed cabin, stall-warning indicator and full electrical equipment including landing lights. Cargo and baggage compartment 107 cu ft, capacity 120 lbs. Rear seat removable for enlarged cargo space. Certificated for Edo floats and Federal skis.

AERONCA Champion Model 7EC T. C. 759

TYPE: Passenger; two-place.

PERFORMANCE: Speed: maximum 110 mph; cruising 100 mph; landing 44 mph. Rate of climb 800 fpm. Cruising range 351 mi. Fuel consumption 5.5 gph.

SPECIFICATIONS: Wingspan 35 ft 2 in; length



ailerons, rudder, elevator. Landing gear: conventional fixed; oleo shock absorbers, hydraulic brakes; tire size: main 7.00 x 6, tail 2.00 x 6; full-swivelled tailwheel. Powerplant: Continental C-145-2. Propeller: Sensenich Model 73BR44



BEECHCRAFT Bonanza Model B-35

T. C. 777

TYPE: Passenger, executive; four-place.

PERFORMANCE: Speed: max. cruising 170 mph at 8000 ft; landing 56 mph with flaps. Rate of climb 890 fpm; service ceiling 17,000 ft. Cruising range 750 mi. Fuel consumption 8.8 gph.

SPECIFICATIONS: Wingspan 32 ft 10 in; length 25 ft 2 in; height 6 ft 7 in. Weight: empty 1575 lbs; gross 2650 lbs; power loading 13.5 lbs/hp. Fuel capacity 39 gals. Wings: low; metal-covered aluminum spar; area 177.6 sq ft; loading 14.9 psf. Fuselage: metal-covered monocoque, flush-riveted. Metal-covered ailerons, empennage and Fowler flaps. Landing gear: tricycle, retractable; swiveling, steerable nose wheel equipped with shimmy-dampener; oleo-pneumatic shock absorbers; tire size: main 6.50 x 8, nose 5.00 x 5. Powerplant: Continental E-185-8. Propeller: Beech electric, continuously variable; diameter 7 ft 4 in.

21 ft 8 in; height 7 ft. Weight: empty 890 lbs; gross 1450 lbs; power loading 16.1 lbs/hp. Fuel capacity 18.5 gals. Wings: high, fabric-covered wooden spar with metal ribs; area 170.2 sq ft; loading 8.5 psf. Fuselage: fabric-covered steel tube. Fabric-covered ailerons, elevator, rudder. Landing gear: conventional fixed; oleo shock absorber; tire size 6.00 x 6; steerable tailwheel. Powerplant: Continental C-90-12F. Propeller: Sensenich wooden; Bendix radio, Willard 12-v battery.

PRICE: \$2695 (FAF standard equipment).

NOTEWORTHY FEATURES

Auxiliary 5.5-gal fuel tank in right wing. Stall-warning indicator, no-bounce landing gear. Optional equipment includes left-wing auxiliary fuel tank, soundproofing, McCauley metal propeller, Bendix PATR-10 transceiver, lighting equipment, Model 7CCM Champion similar to Model 7EC except for lower weight, shorter length and higher climb rate; also certificated for floats and skis at \$2545 FAF.

BAUMANN Brigadier Model B-290

TYPE: Passenger; executive; five-place.

PERFORMANCE: Speed: maximum 175 mph; cruising 155 mph; landing 55 mph. Rate of climb 1250 fpm; service ceiling 18,000 ft. Cruising range 750 mi. Fuel consumption 13 gph.

SPECIFICATIONS: Wingspan 40 ft; length 27 ft 8 in; height 10 ft 5 in. Weight: empty 2200 lbs; gross 3500 lbs; power loading 12 lbs/hp. Wings: midwing; metal-covered aluminum spar; area 207 sq ft; loading 17 psf. Metal-covered ailerons and split trailing-edge flaps; metal-covered elevator, rudder. Fuselage: metal-covered semi-monocoque. Landing gear: tricycle, retractable; oleo shock absorber; tire size: main 6.50 x 10, nose 6.00 x 6, Bendix radio. Powerplant: two Continental C-145-2. Propeller: Sensenich Skyblade.

PRICE: \$23,500 (FAF standard equipment).

CALL Callair Model A-2 & A-3 T. C. 758

TYPE: Passenger; two-place.

PERFORMANCE: Speed: maximum 120 mph; cruising 109 mph; landing 45 mph. Rate of climb



1000 fpm; service ceiling 17,500 ft. Cruising range 456 mi. Fuel consumption 5 gph.

SPECIFICATIONS: Wingspan 35 ft 10 in; length 23 ft 5 in; height 7 ft. Weight: empty 975 lbs; gross 1550 lbs; power loading 12.4 lbs/hp. Fuel capacity 30 gals. Wings: low; fabric-covered wooden spar; metal-covered leading edge; area 181.6 sq ft; loading 8.5 psf. Fuselage: fabric-covered steel tube. Fabric-covered ailerons, rudder, elevator, flaps. Landing gear: conventional, oleo and spring shock absorbers; brakes Firestone hydraulic; steerable tailwheel; tire size: main 7.00 x 6. Bendix radio. Grimes lighting equipment. Powerplant: Lycoming O-290 or Continental C-125-2. Propeller: Sensenich 76JR44.

PRICE:

\$4525 (FAF standard equipment).

NOTEWORTHY FEATURES

Designed for operation from small, rough fields and those at high altitude. Certificated for skis; combination wheel-ski gear optional. Full forward vision with tail down. Wide landing-gear tread. Baggage compartment 27 cu ft.



NOTEWORTHY FEATURES

Improved version of Model A-35 Bonanza, with increased takeoff hp rating, new propeller, faster and increased flap travel, faster retracting action in landing gear. New safety-type control wheel, RCA VHF transceiver, instrument panel design and navigation light reflectors. A new aerodynamic tab on V-tail improves flight characteristics. Baggage compartment 16.5 cu ft, accommodating 270 lbs. Equipped with stall-warning indicator. (Specifications subject to change without notice.)

BEECHCRAFT Twin Bonanza Model 50

TYPE: Passenger, executive, feeder; seven-place.

PERFORMANCE: Speed: cruising over 180 mph; cruising range about 1000 mi.

SPECIFICATIONS: Wings: low; metal-covered aluminum spar. Fuselage: metal-covered monocoque. Landing gear: tricycle, retractable. Powerplant: twin-engine.

NOTEWORTHY FEATURES

Further specifications will be available only after flight tests are completed.



BELLANCA Cruisemaster Model 14-19 T. C. 1A-3



TYPE: Passenger, executive, feeder; four-place.

PERFORMANCE: Speed: max. 225 mph; cruising 180 mph to 8000 ft; landing 43 mph. Rate of climb 1400 fpm; service ceiling 22,500 ft. Cruising range 680 mi. Fuel consumption 11 gph.

SPECIFICATIONS: Wingspan 34 ft 2 in; length 23 ft; height 6 ft 3 in. Weight: empty 1525 lbs; gross 2600 lbs; power loading 13.7 lbs/hp. Fuel capacity 40 gal. Wings: low; cantilever; plastic-bonded laminated spruce wing and spar; are 161.5 sq ft; loading 16.1 psf. Fuselage: fabric-covered steel tube. Fabric-covered ailerons, ele-

vator, rudder, flaps. Landing gear: Conventional, retractable; steerable full-swivel tailwheel; hydraulic shock struts and brakes; tire size: main 6.00 x 6, tail 6.00 x 2. Powerplant: Lycoming O-435A. Propeller: Hartzell Hydro-Selective Model HC-12x20-8, controllable pitch; diameter 6 ft 6 in.

PRICE: \$9500 (FAF standard equipment).

NOTEWORTHY FEATURES

Non-restricted engine. Electromechanically actuated, hydraulically operated landing gear and flaps with spring-lock emergency system and auxiliary manually operated hydraulic pump. Control knobs shaped to resemble items operated. Air-conditioned and soundproofed cabin. Baggage compartment 10 cu ft, capacity 198 lbs. Standard radio equipment: VHF transmitter-receiver, standard receiver and beacon receiver, with rotatable loop, speaker, microphone and headset; wired for omni-mo- ation. Optional equipment includes gyro instruments, auxiliary 25-gal gravity fuel tanks, more efficient propeller and omnirange equipment.

CESSNA Model 190 T. C. 790



TYPE: Passenger, executive, feeder; five-place.

PERFORMANCE: Speed: maximum 170 mph at 7000 ft; cruising 160 mph; landing 62 mph. Rate of climb 1050 fpm; service ceiling 16,000 ft. Cruising range over 700 mi. Fuel consumption 15 gph.

SPECIFICATIONS: Wingspan 36 ft 2 in; length 27 ft 4 in; height 7 ft 2 in. Weight: empty 2050 lbs; gross 3350 lbs; power loading 14 lbs/hp. Fuel capacity 80 gals. Wings: high, cantilever; metal-covered aluminum spar; area 218 sq ft; loading 15.3 psf. Fuselage: metal-covered monocoque. Metal-covered ailerons, elevator, rudder, flaps. Landing gear: conventional fixed; steerable swivel tailwheel; tire size: main 6.50 x 10, tail 10 in. Electrical system 12 v,

25 a. Powerplant: Continental W-670-23. Propeller: Hamilton Standard constant speed; diameter 7 ft 9 in.

NOTEWORTHY FEATURES

Certificated for floats and skis. GE radio standard equipment. Hinged engine mount with Dynafocal suspension. Throw-over control column. Baggage and cargo compartment 85 cu ft; capacity payload 780 lbs.



CESSNA Model 140

T. C. 768

TYPE: Passenger; two-place.

PERFORMANCE: Speed: maximum over 125

mph; cruising over 105 mph; landing 41 mph. Rate of climb 640 fpm; service ceiling 15,500 ft. Cruising range 450 mi. Fuel consumption 6 gph.

SPECIFICATIONS: Wingspan 33 ft 4 in; length 21 ft 6 in; height 6 ft 3 in. Weight: empty 900 lbs; gross 1500 lbs; power loading 16.7 lbs/hp. Fuel capacity 25 gals. Wings: high; metal-covered aluminum spar, leading edge and ribs; area 159.6 sq ft; loading 9.75 psf. Fuselage: metal-covered monocoque. All metal ailerons, elevator, rudder, flaps. Landing gear: conventional fixed; spring steel gear-leg shock absorber; brakes hydraulic friction disc; tread 6 ft 5 in; tire size: main 6.00 x 6. Powerplant: Continental C-90-12F. Propeller: Sensenich fixed pitch; diameter 6 ft 2 in. Electrical system: 12 v, 15 a.

NOTEWORTHY FEATURES

Certificated for floats and skis. Alternate powerplant: Continental C-85-8F. Capacity payload 430 lbs. Wheel fairings optional.



CESSNA Model 170

T. C. 799

TYPE: Passenger; four-place.

PERFORMANCE: Speed: maximum over 140 mph; cruising over 120 mph; landing 55 mph. Rate of climb 690 fpm; service ceiling 15,500 ft. Cruising range 450 mi. Fuel consumption 7 gph.

SPECIFICATIONS: Wingspan 36 ft; length 25 ft; height 6 ft 8 in. Weight: empty 1200 lbs; gross 2200 lbs; power loading 15.5 lbs/hp. Fuel capacity 42 gals. Wings: high; metal-covered aluminum spar; area 175 sq ft; loading 12.8 psf. All-metal ailerons, rudder, elevator, flaps. Fuselage: metal-covered monocoque. Landing gear: fixed conventional. Tire size: main 6.50 x 6; tread 7 ft 2 in. Powerplant: Continental C-145-2. Propeller: Sensenich fixed pitch; diameter 6 ft 1 in.

NOTEWORTHY FEATURES

Certificated for floats and skis. Equipped with muffler, stall-warning indicator, landing-light provisions. Wheel fairings optional. Capacity payload 760 lbs.

CESSNA Model 195

T. C. 790

TYPE: Passenger, executive, feeder, military; five-place.

PERFORMANCE: Speed: maximum 180 mph at 7000 ft; cruising 165 mph; landing 63 mph. Rate of climb 1200 fpm; service ceiling 18,300 ft. Cruising range over 700 mi. Fuel consumption 15 gph. Takeoff and landing distance 1500 ft.

SPECIFICATIONS: Same as Model 190 except weight: empty 2060 lbs; power loading 11.1 lbs/hp. Powerplant: Jacobs R-755A-2.

NOTEWORTHY FEATURES

USAF Model LC-126A. Certificated for floats and skis. Capacity payload 770 lbs. Military version specially modified for Arctic rescue operation and equipped with interchangeable wheel, float and ski landing gear.



CONTINENTAL Airphibian Model FA-2

T. C. Pending

TYPE: Passenger; roadable; two-place.

PERFORMANCE: Speed: maximum 120 mph; cruising 110 mph; landing 55 mph. Rate of climb 600 fpm; service ceiling 12,000 ft. Cruising range 385 mi. Ground speed 50 mph; ground fuel consumption 20 mpg.

SPECIFICATIONS: Fuel capacity 30 gals. Wings: high; fabric-covered steel tube. Fuselage: forward, metal-covered steel tube; aft, fabric-covered steel tube. Fabric-covered ailerons, elevator, rudder, flaps. Landing gear: quadricycle; tire size: 6.00 x 6; brakes hydraulic. Elec-

trical system 12 v. Powerplant: Franklin 335 Model 6A4-150-B3. Propeller: Sensenich ground adjustable, 3-blade.

PRICE: \$10,000 est. (FAF standard equipment).

NOTEWORTHY FEATURES

"Flying automobile" composed of roadable coupe with two-speed transmission, and flight unit consisting of wings, after fuselage and empennage.



deHAVILLAND Chipmunk Model DHC-1B-1



TYPE: Trainer, primary; two-place.

PERFORMANCE: Speed: maximum 140 mph; cruising 124 mph; landing 42 mph. Rate of climb 900 fpm; service ceiling 17,200 ft. Cruis-

ing range 485 mi. Fuel consumption 6.4 gph.

SPECIFICATIONS: Wingspan 34 ft 4 in; length 25 ft 5 in; height 7 ft. Weight: empty 1184 lbs; gross 1930 lbs; power loading 13.3 lbs/hp. Fuel capacity 25 imp. gals. Wings: low; cantilever; metal-covered leading edge and aluminum spar, fabric-covered aft of spar. Fuselage: metal-covered semi-monocoque. Fabric-covered ailerons, elevator, rudder, flaps. Landing gear: conventional fixed; rubber shock absorber; Goodyear hydraulic brakes; tire size: main 6.00 x 6, tail 2.50 x 4; tread 8 ft 9 in. Powerplant: deHavilland Gipsy Major Model 1C. Propeller: Fairey-Reed all-metal. Electrical system 24 v.

NOTEWORTHY FEATURES

Standard trainer for RAF and RCAF Volunteer Reserve. Many built for export. Model DHC-1B-2 powered by deHavilland Gipsy Major Model 10, an improved version of the Model 10, increased from 130 to 145 bhp and can be fitted with electric starter, generator and vacuum pump.

ELDRED Model ED-2



TYPE: Passenger, amphibian/landplane; three-place.

PERFORMANCE: Speed: maximum 128 mph; cruising 115 mph; landing 60 mph. Rate of climb 700 fpm. Cruising range 460 mi. Fuel consumption 13.3 gph.

SPECIFICATIONS: Wingspan 34 ft; length 2 ft 9 in. Weight: empty 1323 lbs; gross 2100 lbs; power loading 14.5 lbs/hp. Fuel capacity 40 gals. Wings: low, cantilever; metal-covered aluminum spar; area 173.5 sq ft; loading 12.1 psf. Fuselage: molded Fiberglas monocoque. Metal-covered ailerons, elevator, rudder. Landing gear: tricycle (twin-float amphibious). Willard battery, Grimes lighting equipment. Powerplant: Continental C-145-2. Propeller: McCauley DM-7644.

NOTEWORTHY FEATURES

Molded Fiberglas fuselage, wingtips and boom-cones. Gull-wing faired into floats. Good transverse stability in water due to wide float tread. Cantilever engine mount. Good stall characteristics and aileron control at stall. No machined, cast or forged parts, thus holding production costs to minimum. Flight-tested as landplane, seaplane and amphibian.

JAMIESON Jupiter

Model J-2L-1

T. C. Pending



torp wooden, fixed-pitch; diameter 6 ft 2 in. Delco-Remy electric starter.

PRICE: \$2500 (FAF standard equipment).

NOTEWORTHY FEATURES

Spinproof with very low stalling speed. Dual

controls and folding wings optional. Landing and navigation lights standard equipment. Steerable nosewheel and no-hunting type, V-tail with controllable tabs on flippers. Said to be going into production immediately with capacity of 120 lbs. Baggage compartment 13 cu ft.

JOHNSON Bullet Model 185

T. C. Pending

TYPE: Passenger, executive; four-place.

PERFORMANCE: Speed: maximum 190 mph; cruising 170 mph; landing 50 mph. Rate of climb 900 fpm; service ceiling 15,000 ft. Cruising range 730 mi. Fuel consumption 9 gph. (All

for the TOPS in Performance, Speed, Economy, Strength, Safety, Style, and Comfort . . .

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"EXTRAS" make this NEW BONANZA a better buy!

- ★ New increased horsepower for better take-off performance
- ★ New safety-type control wheel
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- ★ New RCA Radio with VHF
- ★ Three new utility map pockets
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- ★ New attractive instrument panel design
- ★ New exterior paint design
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Ruggedness plus Speed . . . Performance plus Economy . . . Beauty plus Power

The world-wide operational records of the more than 2200 Beechcraft Bonanzas now in service are *proof* that the Beechcraft Bonanza delivers high payload, high speed, and low operating cost, combined with extra safety and greater comfort — *PROOF* that the NEW Beechcraft Bonanza is a better buy!

It's easy to enter or leave the 4-place Beechcraft Bonanza with its unique retractable step and wide auto-type door. Room for 4 big people to ride in comfort. Maximum 5-way visibility and sound-proofed, smartly appointed cabin add to the limousine luxury of this new Beechcraft Bonanza for 1950.

Compare these performance features

- Top speed, 184 mph
- Cruising speed, 170 mph
- Range, 750 miles
- Service ceiling, 17,100 feet
- Fuel economy, 9½ gal. per hour

Compare these comfort features

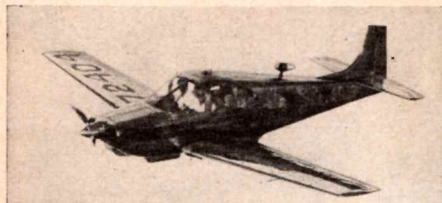
- Exclusive retractable step
- Limousine entrance
- Insulated, sound-proofed cabin
- Quickly removable rear seat
- Luggage compartment accessible two ways

● These are only a few of the hundreds of reasons why the NEW Model B35 Beechcraft Bonanza is a *better buy!* See it today! Get all the facts about the many *extra* advantages of Beechcrafts from your nearest Beechcraft distributor or dealer — or drop a line of request on your company letterhead to Beech Aircraft Corporation, Wichita, Kansas.

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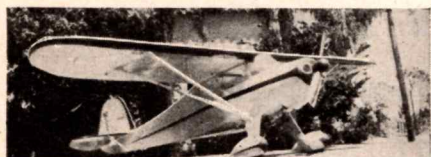
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SPECIFICATIONS: Wingspan 28 ft; length 24 ft 3 in; height 6 ft 6 in. Weight: empty 1300 lbs; gross 2300 lbs; power loading 12.5 lbs/hp. Fuel capacity 55 gals. Wings: low; metal-covered aluminum spar; area 125 sq ft; loading 18.4 psf. Fuselage: metal-covered semi-monocoque. Metal-covered ailerons, elevator, rudder, flaps. Control surface area 38.3 sq ft. Landing gear: conventional retractable; tire size: main 6.00 x 6; tail 6.00 x 2. Bendix radio, Reading battery, GE lighting equipment. Powerplant: Continental E-185-1 with exhaust thrust augmentation. Propeller: Hartzell *Hydro-Selective*.

PRICE: \$4995 (FAF standard equipment).

NOTEWORTHY FEATURES

Air-conditioned and soundproofed cabin. Dual controls, including brakes. Primary blind-flying instruments mounted in indirectly-lighted panel. "Jet" exhaust augmentation becomes effective at 40 mph and reaches peak performance at high altitudes. Rear seats can be removed to enlarge luggage compartment.



MONOCOUE Model 90

T. C. 306

TYPE: Passenger, two-place.

PERFORMANCE: Speed: maximum 156 mph; cruising 135 mph; landing 40 mph. Rate of climb 1000 fpm; service ceiling 16,000 ft. Cruising range 500 mi.

SPECIFICATIONS: Wingspan 32 ft; length 28 ft 6 in; height 6 ft 11 in. Weight: empty 1000 lbs; gross 1610 lbs; power loading 14.8 lbs/hp. Fuel capacity 28 gals. Wings: high; fabric-covered wooden spar; area 151.7 sq ft; loading 10.5 psf. Fuselage: fabric-covered steel tube. Fabric-covered ailerons, rudder, elevator, flaps. Landing gear: conventional fixed; shock-cord shock absorbers; tire size: main 6.00 x 6; steerable tail wheel; rubber brakes. Electrical system 12 v wired for lights and radio. Powerplant: Lycoming O-235C-1. Propeller: McCauley Model 1A110-GF-7650.

PRICE: \$3890 (FAF standard equipment).

NOTEWORTHY FEATURES

Wing stressed for 9½ G's. Available with either wheel or stick control. New-type fully-adjustable seats and newly designed molded-plastic instrument panel. De luxe model equipped with adjustable-pitch propeller, navigation lights and blind-flying instruments. Lycoming Model O-290D (125 hp) engine optional as either standard or de luxe powerplant. Unrestricted aircraft.

Fixed-Base Operations

CIVIL airports with fixed-base operator flight activity, as of July 1, 1949, numbered 3946, according to the CAA. Of these, 82 had charter operations, 264 had instruction activities, 56 rental or sales, 1420 instruction and charter, 223 instruction and rental or sales, 26 charter and rental or sales, 1832 instruction, charter and rental or sales. Only 43 had other types of activity not listed above.

KOPPEN & BOLLINGER Heliplane

TYPE: Passenger; research; two-place.

PERFORMANCE: Data unavailable; minimum flying speed without stall or psin, 27 mph; maximum and cruising speeds said to be comparable with those of similar-sized aircraft. Designed to clear 5-story building within 100 yds of takeoff point and land in area no larger than tennis court. Rate of descent said to be lower than that of a personnel parachute.

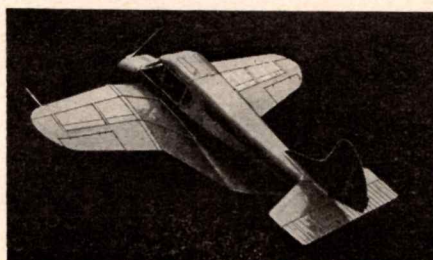
SPECIFICATIONS: Wings: high; fabric-covered. Fuselage: fabric-covered steel tube. Landing gear: conventional fixed; Goodyear crosswind. Powerplant: Continental C-85-12. Propeller: Koppers Aeromatic, constant speed, high-lift, two-blade. Equipped with starter, generator, lighting equipment and radio; full-span flaps and slots.



NOTEWORTHY FEATURES

Revolutionary aircraft designed to land and take-off from exceedingly small fields, and fly at ultra-slow speeds without risk of stall or spin. Unconventional muffler and anti-prop noise system, reducing sound to equivalent of automobile. Initial flight made in April, 1949.

LANIER Paraplane Model 120



TYPE: Passenger; research prototype; two-place.

PERFORMANCE: Speed: cruising over 120 mph; landing under 30 mph. Cruising range

approx. 420 mi. Fuel consumption 35 mpg. Take-off and landing distance 200 ft.

SPECIFICATIONS: Wingspan 20 ft; length 20 ft. Wings: low; cantilever, gull-type *Vacu-jet* airfoil; area 100 sq ft. Fuselage: fabric-covered steel tube. Fabric-covered ailerons, rudder; metal-covered elevator. Landing gear: conventional fixed. Powerplant: 90 hp, opposed. Propeller: wooden, fixed-pitch.

NOTEWORTHY FEATURES

Development of *Vacuplane* Models XL-5 and XL-6, built around Lanier wing, which acts as combination flap, air-chamber air brake and boundary-layer control; will not slip or skid in banks and turns and will not stall or spin. Principle is that of an inverted parachute. A portion of upper wing surface being opened by pilot, creating resultant force opposing gravity which, plus inherent stability, makes possible slow, steep, safe landings.

MONOCOUE Clipped Wing Model 110 T. C. 327

TYPE: Passenger; two-place.

PERFORMANCE: Speed: maximum 220 mph; cruising 190 mph; landing 55 mph. Rate of climb 3000 fpm; service ceiling 20,000 ft.

SPECIFICATIONS: Wingspan 23 ft 2 in; length 20 ft 5 in; height 6 ft 6 in. Weight: empty 1040 lbs; gross 1640 lbs; power loading 8.9 lbs/hp. Fuel capacity 28 gals. Wings: high; fabric-covered wooden spar; area 115 sq ft; loading 15.6 psf. Fuselage: fabric-covered steel tube. Fabric-covered ailerons, rudder, elevator. Landing gear: conventional fixed; rubber-cord shock absorbers; tire size: main 7.00 x 6; hydraulic brakes. Powerplant: Warner Super Scarab Model 185. Propeller: Koppers Aeromatic.

NOTEWORTHY FEATURES

Optional wheel or stick control; newly designed



instrument panel and seats. Improved performance due to increased output and more efficient propeller. Baggage compartment 4 cu ft. Optional dual controls.

MOONEY Model M-18L T. C. 803

PRICE: \$1995 (FAF standard equipment).

NOTEWORTHY FEATURES

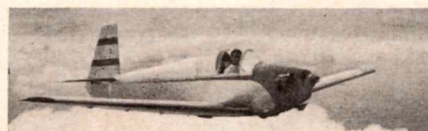
"Safe-trim" control for flaps and stabilizer similar to Culver Model V. Sliding hatch with fiberglass insulation. Air conditioning, engine cowl, propeller spinner, air filter, lighting and radio equipment, stall-warning indicator optional equipment. Baggage compartment 3.3 cu ft, capacity 40 lbs.

MORRISEY Nifty Model 1000-C

TYPE: Passenger; trainer, primary; two-place.

PERFORMANCE: Speed: maximum 122 mph; cruising 110 mph; landing 42 mph. Rate of climb 850 fpm; service ceiling 20,000 ft. Cruising range 300 mi. Fuel consumption 5.2 gph.

SPECIFICATIONS: Wingspan 29 ft; length 20 ft; height 7 ft 2 in. Weight: empty 830 lbs; gross 1350 lbs; power loading 14 lbs/hp. Fuel capacity 15.5 gals. Wings: low cantilever; fab-



TYPE: Passenger; single-place.

PERFORMANCE: Speed: maximum 138 mph; cruising 125 mph; landing 43 mph. Rate of climb 1090 fpm; service ceiling 19,400 ft. Cruising range 390 mi. Fuel consumption 3½ gph.

SPECIFICATIONS: Wingspan 26 ft 10 in; length 17 ft 7 in; height 6 ft 2 in. Weight: empty 500 lbs; gross 780 lbs; power loading 12 lbs/hp. Fuel capacity 11 gals. Wings: low cantilever; wooden spar, plywood-covered leading edge, fabric-covered after portion; area 95 sq ft; loading 8.2 psf. Fuselage: Forward section metal-covered steel tube, aft section fabric-covered plywood monocoque. Fabric-covered ailerons, elevator, rudder, flaps. Landing gear: tricycle, retractable; rubber-disk shock absorber; steerable nosewheel; tire size: 4.00 x 4. Powerplant: Lycoming O-145-B2. Propeller: Sensenich Model 66CB54-52.



PIPER Super Cub-95 Model PA-18 T. C. 1A-2

TYPE: Passenger: two-place.

PERFORMANCE: Speed: maximum 110 mph; cruising 100 mph; landing 44 mph. Rate of climb 624 fpm; service ceiling 13,500 ft. Cruising range 360 mi. Fuel consumption 5 gph.

SPECIFICATIONS: Wingspan 35 ft 4 in; length 22 ft 5 in; height 6 ft 8 in. Weight: empty 790 lbs; gross 1500 lbs; power loading 16.6 lbs/hp. Fuel capacity 18 gals. Wings: high; fabric-covered aluminum spar; area 178.5 sq ft; loading 8.4 psf. Fuselage: fabric-covered steel tube. Fabric-covered ailerons, elevator, rudder. Control surface area 30 sq ft. Landing gear: conventional fixed; rubber shock rings; tire size: main 8.00 x 4, tail 6.00 x 2. Powerplant: Continental C-90-8F (-12F). Propeller: Sensenich Model 72GK50, diameter 6 ft 2 in.

ric-covered wooden spar. Fuselage: Fabric-covered steel tube. Fabric-covered ailerons, rudder, elevator. Control surface area 31 sq ft. Landing gear: tricycle fixed; oil-spring shock absorbers; Goodyear brakes; tread 6 ft 10 in; tire size: main 6.00 x 6, nose 5.00 x 4. Bendix radio, Firestone battery. Powerplant: Continental C-90-12F. Propeller: Sensenich 72GK50.

PRICE: Less than \$2900 (FAF standard equipment).

NOTEWORTHY FEATURES

First low-wing, tricycle-gear tandem aircraft with conventional controls. Constructed of materials and techniques available in all parts of the country. No special machinery, tooling or raw materials necessary.

PIPER Pacer-125 Model PA-20 T. C. 1A-4

TYPE: Passenger, executive; four-place.

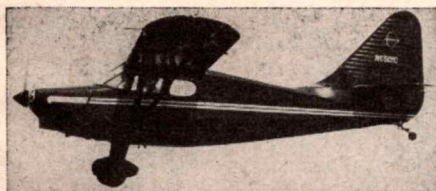
PERFORMANCE: Speed: maximum 135 mph; cruising 125 mph; landing 48 mph. Rate of climb 810 fpm; service ceiling 14,250 ft. Cruising range 545 mi. Fuel consumption 7.7 gph.

SPECIFICATIONS: Same as *Pacer-115* except weight: empty 980 lbs; gross 1800 lbs; power loading 14.4 lbs/hp. Control surface area 43.56 sq ft. Powerplant: Lycoming O-290-D. Propeller: Sensenich 74FM56.

PRICE: \$3795 (FAF standard equipment).

NOTEWORTHY FEATURES

Same as *Pacer-115* except for more powerful engine, flaps and soundproofed cabin as standard equipment, restyled interior.



PIPER-STINSON Station Wagon Model 108-3 T. C. 767

TYPE: Passenger: executive, feeder; four-place.

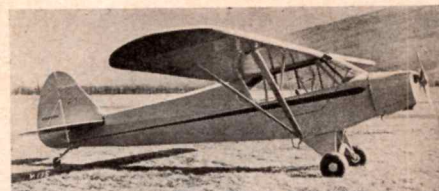
PERFORMANCE: Speed: maximum 133 mph; cruising 130 mph; landing 61 mph. Rate of climb 580 fpm; service ceiling 15,500 ft. Cruising range 554 mi. Fuel consumption 10 gph.

SPECIFICATIONS: Wingspan 34 ft; length 25 ft 2 in; height 7 ft 6 in. Weight: empty 1320 lbs; gross 2400 lbs; power loading 14.5 lbs/hp. Fuel capacity 50 gals. Wings: high; fabric-covered aluminum spar; area 155 sq ft; loading 15.5 psf. Fuselage: Fabric-covered steel tube. Fabric-covered ailerons, metal-covered elevator, rudder, slotted flaps. Landing gear: conventional; hydraulic brakes; steerable, full-swiveling tailwheel; tread 7 ft 1 in; tire size: main 7.00 x 6, tail 6.00 x 2. Powerplant: Franklin 335 Model 6A4-165-B3. Propeller: Sensenich 76JR53, diameter 6 ft 4 in. Hallcraft radio, Reading battery, Grimes lighting equipment.

PRICE: \$6484 (FAF standard equipment).

NOTEWORTHY FEATURES

Similar to former Stinson *Voyager-165*, with removable rear seats. With seats removed, rear cabin accommodates 640 lbs of cargo. Air-conditioned and soundproofed cabin. Certificated for floats and skis.



PRICE: \$2795 (FAF standard equipment).

NOTEWORTHY FEATURES

New version of Model PA-11 *Cub Special* and *Trainer*. GE radio, Reading battery and Grimes lighting units, optional equipment. Baggage compartment 7 cu ft; with rear seat folded, capacity is 400 lbs. Engineered for agricultural application, light cargo transport and instruction. Certificated for floats and skis.

PIPER Super Cub-105 Model PA-18 T. C. 1A-2

TYPE: Passenger: two-place.

PERFORMANCE: Speed: maximum 115 mph; cruising 105 mph; landing 38 mph. Rate of climb 780 fpm; service ceiling 15,750 ft. Cruising range 270 mi. Fuel consumption 7 gph.

SPECIFICATIONS: Same as *Super Cub-95* except weight: empty 825 lbs; power loading 14 lbs/hp. Control surface area 41.5 sq ft. Power-

plant: Lycoming O-235-C1. Propeller: Sensenich M76M-2.

PRICE: \$2995 (FAF standard equipment).

NOTEWORTHY FEATURES

Same as *Super Cub-95* except for more powerful engine and installation of fabric-covered flaps and balanced elevators.

PIPER Pacer-115 Model PA-20 T. C. 1A-4

TYPE: Passenger, executive; four-place.

PERFORMANCE: Speed: maximum 125 mph; cruising 112 mph; landing 50 mph. Rate of climb 600 fpm; service ceiling 11,000 ft. Cruising range 580 mi. Fuel consumption 7 gph. (Pending change in gross weight expected to invalidate data shortly.)

SPECIFICATIONS: Wingspan 29 ft 4 in; length 20 ft 5 in; height 6 ft 2 in. Weight: empty 900 lbs; gross 1700 lbs; power loading 15.7 lbs/hp. Fuel capacity 36 gals. Wings: fabric-covered aluminum spar; area 147.5 sq ft; loading 11.5 psf. Fuselage: fabric-covered steel tube. Fabric-covered ailerons, elevator, rudder. Control surface area 34 sq ft. Landing gear: conventional

fixed; tire size: main 8.00 x 4, tail 6.00 x 2; oleo shock absorber. Powerplant: Lycoming O-235-C1. Propeller: Sensenich M76AM-2, diameter 6 ft 2 in. GE radio, Reading battery, Grimes lighting equipment.

PRICE: \$3295 (FAF standard equipment).

NOTEWORTHY FEATURES

Improved version of Model PA-14 *Family Cruiser* and Model PA-16 *Clipper*. New, wheel-type controls, redesigned instrument panel, wing tanks replacing fuselage tank and re-engineered *Hydrasorb* landing gear. Balanced elevator; flaps optional. Crossover exhaust system, which gives increased power output. Cargo and baggage compartment 36.5 cu ft, capacity 50 lbs.

PIPER Pacer-135 Model PA-20 T. C. 1A-4

TYPE: Passenger: executive; four-place.

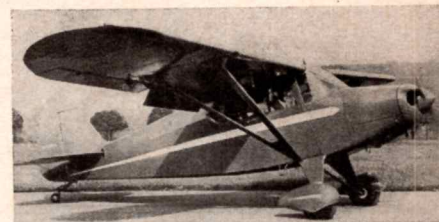
PERFORMANCE: Speed: maximum 140 mph; cruising 134 mph at 5000 ft; landing 48 mph. Rate of climb 850 fpm. Cruising range 580 mi. Fuel consumption 7.7 gph.

SPECIFICATIONS: Same as *Pacer-125* except Weight: empty 1000 lbs. Propeller: Koppers Aeromatic Model F-200H controllable pitch.

PRICE: \$4265 (FAF standard equipment).

NOTEWORTHY FEATURES

Same as *Pacer-125* except change in propeller



and addition of manifold pressure gage, outside temperature gage and wheel fairing kit.

RAWDON Model T-1 T. C. 794

TYPE: Passenger: agricultural; two-place.

PERFORMANCE: Speed: maximum 138 mph; cruising 120 mph; landing 50 mph. Rate of climb 815 fpm; service ceiling 17,000 ft. Cruising range 415 mi. Fuel consumption 8 gph. Takeoff distance 700 ft over 50-ft obstacle.

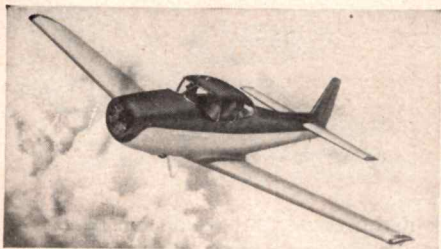
SPECIFICATIONS: Wingspan 33 ft 4 in; length 24 ft 2 in; height 7 ft 3 in. Weight: empty 1225 lbs; gross 1800 lbs; power loading 14.4 lbs/hp. Fuel capacity 30 gals. Wings: low; fabric-covered wooden spar; area 166 sq ft; loading 10.7 psf. Fuselage: fabric-covered steel tube. Fabric-covered ailerons, elevator, rudder, flaps. Landing gear: conventional fixed; oleo-spring shock absorber; full-swiveling, steerable tailwheel; Goodyear wheels and brakes; tire size: main 7.00 x 6, tail 6 in; tread 10 ft 3 in. Powerplant: Lycoming O-290-C. Propeller: McCauley 1A170. Lear radio, Exide battery.



PRICE: \$5585 (FAF standard equipment).

NOTEWORTHY FEATURES

Unrestricted for aerobatics. Currently being sold equipped for agricultural application. Said to closely approximate requirements for ideal agricultural aircraft as set forth by Texas A&M-CAA study.



RYAN Navion B, Super Model 260 T. C. Pending

TYPE: Passenger: executive; feeder; four-place.

PERFORMANCE: Speed: maximum 174 mph; cruising 170 mph; landing 55 mph. Rate of climb 1250 fpm; service ceiling 18,000 ft. Cruising range 640 mi. Fuel consumption 13 gph.

SPECIFICATIONS: Same as De Luxe Model 205 except weight: empty 1897 lbs; gross 2850 lbs; power loading 10.9 lbs/hp; wing loading 15.4 psf. Fuel capacity 60 gals. Powerplant: Lycoming GO-435-C2. Propeller: Koppers Aeromatic Model 220 with O-93 blades.

PRICE: \$13,985 (FAF standard equipment).

NOTEWORTHY FEATURES

Same as De Luxe Model 205 except more powerful engine and increased fuel capacity with consequent increased performance.

RYAN Navion A, De Luxe Model 205 T. C. 782

TYPE: Passenger; executive, feeder; four-place.

PERFORMANCE: Speed: maximum 163 mph; cruising 155 mph; landing 54 mph. Rate of climb 900 fpm; service ceiling 15,600 ft. Cruising range 500 mi. Fuel consumption 10.5 gph.

SPECIFICATIONS: Same as Utility Model 205 except weight: empty 1782 lbs. Propeller: Hartzell Model HC-12X20-7.

PRICE: \$10,985 (FAF standard equipment).

NOTEWORTHY FEATURES

Similar to Utility Model 205 except for installation of more efficient propeller and consequent increased performance. Standard equipment includes controllable cowl flaps, underwing exhaust outlets, dual controls, cylinder-head temperature gage, new air-conditioning system and radio antennae. Elaborate interior furnishings and distinctive choice of color scheme.



TAYLORCRAFT Custom De Luxe Model BC12D-85 T. C. A-696

TYPE: Passenger: two-place.

PERFORMANCE: Speed: max. 120 mph; cruising 110 mph; landing 38 mph. Rate of climb 700 fpm; service ceiling 17,000 ft. Cruising range 350 mi. Fuel consumption 5 gph.

SPECIFICATIONS: Same as Special De Luxe except gross weight 1280 lbs; power loading 15 lbs/hp; wing loading 7 psf. Powerplant: Continental C-85-12F.

PRICE: \$2585 (FAF standard equipment).

NOTEWORTHY FEATURES

Similar to Special De Luxe Model BC12B-65 except more powerful engine and consequently improved performance. Two cabin skylights, new improved exhaust system and 17-cu ft baggage compartment.

RYAN Navion A, Utility Model 205

T. C. 782

TYPE: Passenger: executive, industrial; four-place.

PERFORMANCE: Speed: maximum 157 mph; cruising 150 mph; landing 54 mph. Rate of climb 830 fpm; service ceiling 15,600 ft. Cruising range 500 mi. Fuel consumption 10.5 gph.

SPECIFICATIONS: Wingspan 33 ft 4 in; length 27 ft 3 in; height 8 ft 8 in. Weight: empty 1721 lbs; gross 2750 lbs. Power loading 14.6 lbs/hp. Fuel capacity 40 gals. Wings: low cantilever; metal-covered aluminum stub spar; area 185 sq ft; loading 14.6 psf. Fuselage: metal-covered semi-monocoque, stressed-skin. Metal-covered ailerons, elevator, rudder, flaps. Landing gear: tricycle retractable; oleo-pneumatic shock absorber; steerable nosewheel; tread 8 ft 3 in; tire size: main 7.80 x 8, nose 6.00 x 6. Powerplant: Continental E-185-3. Propeller: Koppers Aeromatic Model 220 with O-85 blades. RCA



VHF radio, Exide 15-v battery, Grimes lighting equipment.

PRICE: \$9485 (FAF standard equipment).

NOTEWORTHY FEATURES

Coordinated aileron and elevator for "two-control" flying. Control handles shaped to resemble items operated. Selective, partial flap adjustment. Hydraulically-operated landing gear, with spring-loaded emergency system. Sliding canopy with ultraviolet ray-absorbing Lucite windows. Rear seats can be folded forward or removed, increasing normal 20-cu ft baggage compartment to a 46-cu ft cargo compartment. Standard equipment.

SANDERS Erco Coupe Club-Air Model G T. C. 787



TYPE: Passenger: two-place.

PERFORMANCE: Speed: maximum 125 mph; cruising 110 mph; landing 48 mph. Rate of climb 560 fpm; service ceiling 11,000 ft. Cruising range 430 mi. Fuel consumption 5 gph.

SPECIFICATIONS: Wingspan 30 ft; length 20 ft 3 in; height 5 ft 6 in. Weight: empty 838

lbs; gross 1400 lbs; power loading 16.5 lbs/hp. Fuel capacity 24 gals. Wings: low; metal-covered aluminum spar; area 138 sq ft; loading 9.87 psf. Fuselage: metal-covered semi-monocoque. Metal-covered ailerons, elevator, rudder. Landing gear: tricycle fixed; Erco hydraulic shock absorbers; steerable nosewheel; Goodyear single-disk brakes; tire size: main 6.00 x 6, nose 5.00 x 5. Powerplant: Continental C-85-12. Propeller: Sensenich Model 74FKT48. Lear radio, Reading battery, Erco lighting equipment.

NOTEWORTHY FEATURES

Baggage compartment 8 cu ft; can be converted into seat for child under 75 lbs. Two-control, spinproof, stall-warning cushion. Air-conditioned and soundproofed cabin, convertible to open cockpit with bubble canopy. New, lateral trim control for cross-country flying. Three-control feature optional; conversion kits for two-control aircraft available.

TAYLORCRAFT Special De Luxe Model BC12D-65 T. C. A-696

TYPE: Passenger; two-place.

PERFORMANCE: Speed: max. 103 mph; cruising 95 mph; landing 37 mph. Rate of climb 680 fpm; service ceiling 15,000 ft. Cruising range 375 mi. Fuel consumption 4 gph.

SPECIFICATIONS: Wingspan 36 ft; length 21 ft 9 in; height 6 ft 10 in. Weight: empty 730 lbs; gross 1200 lbs; power loading 18.5 lbs/hp. Fuel capacity 18 gals. Wings: high; fabric-covered wooden spar; area 183.5 sq ft; 6.5 psf. Fuselage: fabric-covered steel tube. Fabric-covered ailerons, elevator, rudder. Control surface area 68.8 sq ft. Landing gear: conventional fixed;

rubber cord shock absorber, steerable tailwheel, tread 6 ft; tire size: main 6.00 x 6, tail 6.00 x 2. Powerplant: Continental A-65-8. Propeller: Sensenich 72CK44 or McCauley 1A-90.

PRICE: \$2195 (FAF standard equipment).

NOTEWORTHY FEATURES

Wheel controls, cabin heater, roof and rear window, doors on both sides, completely wired for lights. Baggage compartment 2.6 cu ft. Optional equipment includes wheel fairings, radio equipment, metal propeller, starter and electrical equipment, including battery, generator and lights. Certificated for floats and skis.

TAYLORCRAFT Tourist Model 15 T. C. Pending

TYPE: Passenger: executive; four-place.

PERFORMANCE: Speed: max. 125 mph; cruising 115 mph; landing 36 mph. Rate of climb 700 fpm; service ceiling 16,000 ft. Cruising range 500 mi. Fuel consumption 8.5 gph.

SPECIFICATIONS: Wingspan: 36 ft 3 in; length 24 ft; height 7 ft 1 in. Weight: empty 1325 lbs; gross 2200 lbs; power loading 15 lbs/hp. Fuel capacity 40 gals. Wings: high; fabric-cov-

ered wooden spar; area 186.3 sq ft; loading 11.7 psf. Fuselage: fabric-covered steel tube. Fabric-covered elevator, rudder, metal-covered ailerons, flaps. Landing gear: conventional fixed; rubber-cord shock absorbers. Electrical system 12 v. Powerplant: Continental C-145-2.

PRICE: \$4895 est. (FAF standard equipment). Front and rear cabin doors, hydraulic brakes, indirectly lighted chrome instrument panel, pneumatic landing gear, slotted wings.

TAYLORCRAFT Sportsman Model BC12D-4-85 T. C. A-696

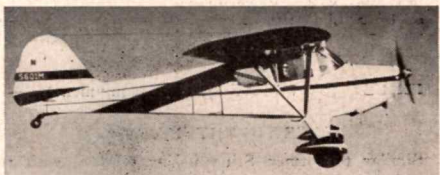
TYPE: Passenger; two-place.

PERFORMANCE: Speed: max. 115 mph; cruising 110 mph; landing 42 mph. Rate of climb 860 fpm; service ceiling 17,000 ft. Cruising range 440 mi. Fuel consumption 4.5 gph.

SPECIFICATIONS: Same as Custom De Luxe Model except empty weight 850 lbs; power loading 15 lbs/hp; wing loading 7 psf. Battery 12-v.

NOTEWORTHY FEATURES

Same as Custom De Luxe Model BC12B-85 except battery, starter, generator, voltage regulator, ammeter and stall-warning indicator are standard equipment. Navigation lights, complete new exhaust and cabin-heating system. Optional equip-



ment includes radio equipment, metal propeller and wheel fairings.



TEMCO Swift-125 Model GC-1B T. C. 766

TYPE: Passenger; two-place.

PERFORMANCE: Speed: max. 150 mph; cruising 140 mph; landing 56 mph. Rate of climb 1000 fpm; service ceiling 16,000 ft. Cruising range 425 mi. Fuel consumption 8 gph.

SPECIFICATIONS: Wingspan 29 ft 2 in; length 20 ft 11 in; height 5 ft 10 in. Weight: empty 1185 lbs; gross 1710 lbs; power loading 13.7 lbs/hp. Fuel capacity 26.5 gals. Wings: low cantilever; all-metal with detachable tips; area 131.6 sq ft; loading 12 psf. Fuselage: metal-covered semi-monocoque. Metal-covered Frise-type ailerons, elevator, rudder, slotted flaps. Landing

gear: conventional retractable; oil-spring shock absorber; non-retractable, steerable tailwheel; tread 9 ft 9 in; hydraulic brakes. Tire size: main 6.00 x 6, GE radio, Willard battery. Powerplant: Continental C-125-2. Propeller: Koppers Aeromatic F-200 variable pitch.

\$4495 (FAF standard equipment).

NOTEWORTHY FEATURES

Electro-hydraulic flaps and landing gear, with emergency mechanical system for lowering landing gear. Dual controls. Baggage compartment 10 cu ft; capacity 100 lbs. Navigation lights standard equipment. Landing lights optional.

TRELLA

Special Model T-21

T. C. Pending

TYPE: Passenger; two-place.

PERFORMANCE: Speed: max. 105 mph; cruising 95 mph; landing 45 mph. Rate of climb 700 fpm; service ceiling 19,000 ft. Cruising range 425 mi. Fuel consumption 4.5 gph.

SPECIFICATIONS: Wingspan 34 ft; length 21 ft 6 in; height 5 ft 10 in. Weight: empty 980 lbs; gross 1500 lbs; power loading 17.6 lbs/hp. Fuel capacity 20 gals. Wings: high-metal covered aluminum spar; area 164 sq ft; loading 9.15 psf. Fuselage: metal-covered semi-monocoque. All-metal ailerons, tailbooms, elevator, rudder. Control surface area 16 sq ft. Landing gear: tricycle fixed; oil-spring shock absorbers. Tire size: main 6.00 x 6, nose 5.00 x 5. Bendix radio, Exide battery. Powerplant: Continental C-85-12J. Propeller: Sensenich.

\$3800 (FAF standard equipment).



NOTEWORTHY FEATURES

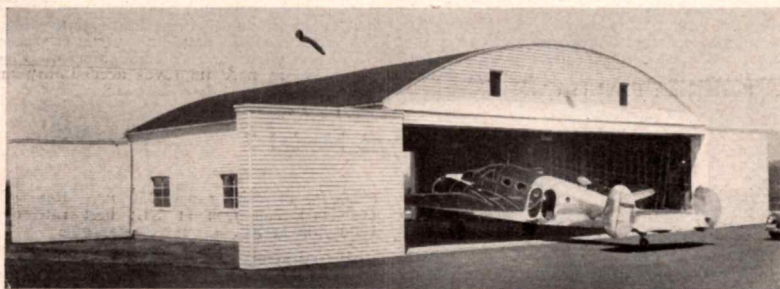
Pusher-engine installation with tailbooms and wing-struts acting as propeller safety feature. Baggage compartment 6 cu ft. Designer was formerly chief engineer for Waco Aircraft Corp.

Cal-Aero Trains Reservists

A COMPLETE training program for Air Force reservists has been proposed at Cal-Aero Technical Institute paraling the courses Cal-Aero students are now taking in preparation for an A & E Mechanic's license, plus basic military training.

This unit is to be incorporated into the 496th Air Base Group of the Air Material Command, whose objective is to man and train a group which, in time of national emergency, can take over the responsibilities of an Air Depot.

Low-Cost Hangar



UTILITY, appearance and practical design have been combined successfully at low cost in an airplane hangar recently completed at Tacoma Airport, Wash. The 60 x 60-ft wooden building features bowstring timber roof trusses and can accommodate two twin-engine Beechcrafts.

The total cost of the structure was a little over \$10,500, including cost of the concrete-slab floor. The building has an outside wing, 20 x 24-ft, that can be used as a 4-car

parking space, office and workshop. Four 12 x 15-ft doors on each end furnish a full 60-ft traffic lane for hangar access.

Four 60-ft stress-grade, Douglas fir, Monocord trusses support the three-ply built-up roof, which is placed on 1-in diagonally-laid roof sheathing. Trusses are spaced 20-ft apart and the bottom chords of the two end trusses carry monorails on which the doors move.

Aviation Earnings

Beech Aircraft Corp. has voted a quarterly dividend of 20c per share on its common stock, making a total of 45c per share for the first six months of the present fiscal year. The company's backlog is approximately \$11,000,000 and first quarter sales totaled \$3,088,747.

Net income of **Bendix Aviation Corp.** for the year ended Sept. 30, 1949 was \$11,086,781, compared with \$11,280,742 for 1948. However, 1949 sales amounted to \$182,674,462 while 1948 sales were \$162,495,665.

Delta Air Lines reports an operating profit of \$706,867 and a net profit, after taxes, of \$450,967 for the calendar year 1949.

The Garrett Corp. has declared a quarterly dividend of 25c per share, plus an extra dividend of 25c per share, to stockholders of record March 1, 1950. The company's consolidated net profit for the six months ended Dec. 31, 1949 was approximately \$830,000. The **AiResearch Mfg. Co.** division reported a backlog of \$16,000,000.

Regular dividends of \$1.25 per share on the \$5 preferred and \$1.00 per share on common stock were declared by the **Good-year Tire & Rubber Co.**, to stockholders of record Feb. 15, 1950.

Net profit of the **Miami International Airport** for the fiscal year ended Sept. 30, 1949 was \$351,297.33. Income from all sources totaled \$1,284,477.91.

MAA Elections

WILLIAM E. VALK has been re-elected president of the Manufacturers Aircraft Assn. The following vice-presidents were also reelected: Horace G. Hitchcock, Robert E. Gross, J. H. Kindelberger, W. T. Piper, Haycroft Walsh and John A. Sanborn.

James P. Murray was reelected secretary and Charles Kingsley reelected treasurer.

The new board of directors is comprised of F. A. Boettger, Cessna; A. T. Burton, North American; C. H. Chatfield, United Aircraft; J. E. Coates, Douglas; G. T. Gerlach, Convair; M. E. Hogan, Martin; Charles Kingsley, Gruman; H. H. Munsey, Bell; J. P. Murray, Boeing; W. T. Piper, Piper Aircraft; L. B. Richardson, Fairchild; G. C. Sullivan, Lockheed; W. E. Valk, Convair; H. L. Wichman, McDonnell; and C. S. Wilson, Republic.

Aircraft Delivery

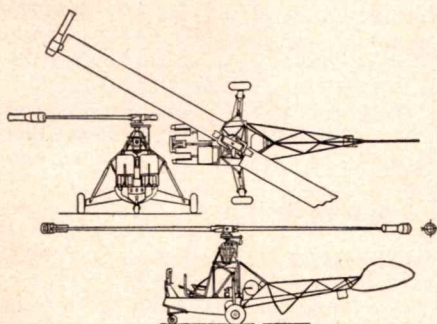
FERRY SERVICE CO. announces that it handles insured deliveries of all types of aircraft anywhere in the U. S. or any foreign country accessible by land or float plane.

Since its inception in 1945, the firm has ferried nearly 4000 aircraft from factory to domestic and foreign buyers.

- Rhodes Lewis Co., designers and manufacturers of precision aircraft and ordnance equipment, has moved from Los Angeles to a new and larger plant at Culver City, Calif.

- The Electric Storage Battery Co. announces lower prices on Exide automotive replacement batteries. Price reductions average approximately 9%.

1950 Annual Directory of ROTARY WING AIRCRAFT



AMERICAN Model XA-5 Top Sargent

TYPE: Experimental military; two-place.

PERFORMANCE: Speed: maximum 80 mph at SL (est.); ceiling 14,000 ft (est.).

SPECIFICATIONS: Length 20 ft 4 in; height 8 ft 2 in; rotor diameter 33 ft. Weight: empty 920 lbs; gross 1500 lbs. Fuel capacity 50 gal. Rotor: single; two fabric-covered, wooden seesaw blades; disc loading 1.75 psf; chord 20 in; tip speed 350 fpm; power loading 18.6 lbs/hp. Fuselage: fabric-covered steel tube. Powerplant: American Helicopter AJ-8.75 engines. Landing gear: tricycle.

NOTEWORTHY FEATURES

Utility helicopter powered by pulsejet engines, mounted on rotor blade tips, being developed for US Air Force.



BELL Model 47D-1 T. C. 1-H

TYPE: Passenger, industrial-agricultural, military; three-place.

PERFORMANCE: Speed: maximum 92 mph at SL; cruising 85 mph at SL. Absolute ceiling 11,000 ft; hovering ceiling 8500 ft. Cruising range 200 mi. Best rate of climb 1000 fpm at SL.

SPECIFICATIONS: Length 41 ft 5 in; height 9 ft 1 in; rotor diameter 35 ft 2 in. Weight: empty 1380 lbs; gross 2200 lbs. Fuel capacity 29 gal. Main rotor: single; two fabric-covered, rigid wooden blades; disc loading 2.3 psf; power loading 12.3 lbs/hp; reduction ratio 9:1; tip speed 60 fpm. Tail rotor: two fabric-covered, rigid wooden blades; diameter 5 ft 8 in. Fuselage: steel tube. Landing gear: quadricycle. Powerplant: Franklin 6V4-178-B32.

PRICE: \$23,500 (FAF standard equipment).

NOTEWORTHY FEATURES

USAF Model H-13. USN Model HTL-2. De luxe model has fabric-covered fuselage.

BELL Model 48

TYPE: Military; five-place.

PERFORMANCE: Speed: maximum 115 mph at SL; cruising 90 mph at 5000 ft. Absolute ceiling 15,000 ft; hovering ceiling 5000 ft. Cruising range 300 mi. Best rate of climb 1050 fpm.

SPECIFICATIONS: Length 39 ft 8 in; height 11 ft 6 in; rotor diameter 47 ft 6 in. Weight: empty 4450 lbs; gross 6286 lbs. Fuel capacity 200 gal. Main rotor: single; two fabric-covered, rigid wooden blades; disc loading 3.4 psf; power loading 10.5 lbs/hp; reduction ratio 8:1. Tail rotor: two fabric-covered, rigid wooden blades; diameter 8 ft 6 in. Fuselage: aluminum-alloy covered semi-monocoque. Landing gear: quadricycle. Powerplant: Pratt & Whitney Wasp H R-1340.



BELL Model 54

TYPE: Military; two-place.

PERFORMANCE: Restricted. (AD 1949 Directory listed maximum speed over 100 mph and cruising range of 100 mi).

SPECIFICATIONS: Length 43 ft 9 in; height 9 ft 2 in; rotor diameter 37 ft 4 in. Weight: empty 2000 lbs; gross 2700 lbs. Fuel capacity 50 gal. Main rotor: single; two fabric-covered, rigid wooden blades; chord 15.8 in; reduction ratio 9.8:1. Tail rotor: two fabric-covered, rigid wooden blades; diameter 6 ft 6 in. Fuselage: metal-covered aluminum alloy. Landing gear: tricycle. Powerplant: Continental XO-470-9 or Franklin XO-425-7.

NOTEWORTHY FEATURES

USAF Model XH-15. Rotors have steel core and stainless-steel leading edge, with doped, fiber-glass fabric covering.

DOMAN Pelican Model LZ-2A

TYPE: Passenger, industrial-agricultural, military; seven-place.

DESIGN PERFORMANCE: Speed: maximum 85 mph at SL; cruising 75 mph at SL. Ceiling 3300 ft. Cruising range 225 mi. Rate of climb (vertical) 464 fpm at SL; best rate of climb 1135 fpm at SL.

SPECIFICATIONS: Length 35 ft 9 in; height 9 ft 3 in; rotor diameter 45 ft. Weight: empty 1800 lbs; gross 3200 lbs. Fuel capacity 75 gals. Main rotor: single; four wooden blades; gimbal-mounted hub; disc loading 2 psf; power loading 13.1 lbs/hp; chord 14.3 in; reduction ratio 15:1; tip speed 471 fpm. Tail rotor: three wooden blades; gimbal-mounted hub; reduction ratio 2.2:1; tip speed 569 fpm; diameter 8 ft. Fuselage: fabric-covered steel tube. Landing gear: tricycle. Powerplant: Franklin 6AL-500.

GCA Helidyne Model 7



8800 ft; cruising range 250 mi. Rate of climb (vertical) 760 fpm at SL; best rate of climb 1300 fpm at SL.

SPECIFICATIONS: Length 52 ft; height 15 ft; rotor diameter 52 ft. Weight: empty 4646 lbs; gross 7600 lbs. Fuel capacity 300 gals. Rotors: coaxial; two all-metal seesaw blades per rotor; disc loading 3.6 psf; power loading 10.1 lbs/hp; chord 21 in; gear ratio 13:1; tip speed 625-845 fpm. Fuselage: metal-covered aluminum alloy. Landing gear: tricycle. Powerplant: two Lycoming GSO-580.

PRICE: \$125,000 (FAF standard equipment).

NOTEWORTHY FEATURES

Low operating cost induced by high cruising speed. A stub wing will have a span of 26 ft. Sealed lower fuselage and wing act as sponsons making water landings possible without floats. Claimed to be among first convertible aircraft permitting both helicopter and airplane flight. Prototype is illustrated.



GCA Gyrodyne Model 5

TYPE: Passenger, military; three-place.

PERFORMANCE: Speed: maximum 161 mph at 10,000 ft; cruising 155 mph at 7700 ft. Ceiling 14,700 ft. Cruising range 264 mi. Rate of climb (vertical) 760 fpm at SL; best rate of climb 1200 fpm at SL.

SPECIFICATIONS: Length 43 ft; height 9 ft 4 in; rotor diameter 36 ft. Weight: empty 2035 lbs; gross 2795 lbs. Fuel capacity 80 gals. Main rotor: single; four all-metal seesaw blades; disc loading 2.75 psf; power loading 10.2 lbs/hp; chord 10 in; gear ratio 9:1; tip speed 587-815 fps. Tail rotor: two rigid all-metal blades; diameter 7 ft; gear ratio 1.2:1; tip speed 860 fps. Fuselage: metal-covered aluminum alloy. Landing gear: tricycle. Powerplant: Continental XO-470-5.

PRICE: \$18,000 (FAF standard equipment).

NOTEWORTHY FEATURES

Forward propulsion derived from tail rotor acting as pusher propeller. Blade-flapping lessened by reduction in rotor feathering requirements. Rotor incorporates a dynamic stabilizing mechanism and an automatic pitch governor.



HOPPI-COPTER Model 105B

TYPE: Passenger; single-place.

PERFORMANCE: Speed: maximum 90 mph at 1000 ft (est.). Cruising range 200 mi.

SPECIFICATIONS: Height 8 ft; rotor diameter 16 ft. Weight: empty 240 lbs. Fuel capacity 2 gals. Rotors: coaxial; two fabric-covered, hinged blades per rotor; gear reduction 10:1; tip speed 368 fps. Fuselage: steel tube. Landing gear: tricycle. Powerplant: modified "Triumph" T-100/Grand Prix.

McDONNELL Whirlaway



TYPE: Experimental; research; 10-place.

PERFORMANCE: Speed: maximum 110 mph at

GCA Coaxial Model 2

TYPE: Passenger, industrial, military; five-place.

PERFORMANCE: Speed: maximum 112 mph at SL; cruising 89 mph at 2300 ft. Ceiling 7000 ft. Cruising range 270 mi. Rate of climb (vertical) 840 fpm at SL; best rate of climb 1460 fpm at SL.

SPECIFICATIONS: Length 43 ft; height 14 ft 4 in; rotor diameter 48 ft. Weight: empty 3600 lbs; gross 5400 lbs. Fuel capacity 100 gals. Rotors: coaxial; two seesaw wooden blades per rotor; disc loading 3 psf; power loading 12 lbs/hp; chord 18 in; gear ratio 12:1; tip speed 480-570 fps. Fuselage: metal-covered aluminum alloy. Landing gear: tricycle. Powerplant: Pratt & Whitney Wasp Jr. Model B-4 (R-985).

PRICE: \$75,000 (FAF standard equipment).

NOTEWORTHY FEATURES

Previously designated as Bendix Model J and Helicopters, Inc. Whirlaway. Requires smallest



KAMAN Model K-22S

TYPE: Passenger, industrial-agricultural, military; three-place.

PERFORMANCE: Speed: maximum 73 mph at SL; cruising 65 mph at SL. Ceiling 4000 ft. Cruising range 200 mi. Rate of climb (vertical) 300 fpm at SL; best rate of climb 1000 fpm at SL.

SPECIFICATIONS: Length 23 ft; height 11 ft; rotor diameter 38 ft. Weight: empty 1800 lbs; gross 2500 lbs. Fuel capacity 40 gals. Rotors: side-by-side intermeshing; two hinged, seesaw, fabric-covered wooden blades per rotor; chord 6-8 in; gear reduction 13:1; tip speed 470 fps. Fuselage: partially fabric-covered steel tube. Landing gear: tricycle. Powerplant: Lycoming O-435.

PRICE: \$25,000 (FAF standard equipment).

NOTEWORTHY FEATURES

Developed from Model K-190. Presently in military use by Navy and Coast Guard.

KELLETT Model XH-10

TYPE: Transport, military; 12-place.

NOTEWORTHY FEATURES

Undergoing further development and construction. Commercial version (Model KH-2) has been fully engineered and is in full-scale mock-up.

SL; cruising 100 mph. Ceiling 12,000 ft. Cruising range 350 mi. Rate of climb 1300 fpm at SL.

SPECIFICATIONS: Length 32 ft 6 in; height 12 ft 3 in; rotor diameter 50 ft (9 ft intermesh). Weight: empty 8000 lbs; gross 11,000 lbs. Fuel capacity 195 gals. Rotors: side-by-side, intermeshing; three fabric-covered wooden blades per rotor; disc loading 3 psf; power loading 12.3 lbs/hp; chord 15 in; gear ratio 10.5:1; tip speed 530 fps. Fuselage: fabric-covered steel tube. Landing gear: quadricycle. Powerplant: two Pratt & Whitney Wasp Jr. Model B (R-985).

NOTEWORTHY FEATURES

USN Model XHJD-1. Developed to carry out flight-research program towards a practical air-sea-rescue craft. Over-all span from rotor tip to rotor tip is 41 ft. Either engine will drive both rotors and, when engines are throttled or if one stops, they are automatically disengaged. Horizontal stabilizer is adjustable. Production models will have monocoque fuselage.



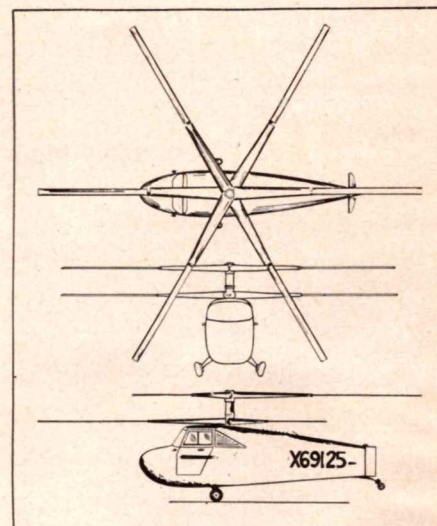
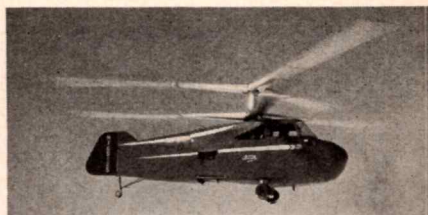
storage and operational space of any craft of equal capacity. No ground resonance or lateral azimuth forces. Coaxial rotor system permits vertical descent to be arrested for long periods during power-off landings.

PENN ELASTIC Brantly Model B-1

TYPE: Passenger, industrial; two-place.

PERFORMANCE: Speed: cruising 95 mph. Cruising range 380 mi.

SPECIFICATIONS: Length 17 ft 6 in; height 7 ft 9 in; rotor diameter 29 ft 6 in. Weight: empty 1300 lbs; gross 2000 lbs. Fuel capacity



36 gals. Rotors: coaxial; three hinged, all-metal blades per rotor; disc loading 2.9 psf; power loading 13.3 lbs/hp; chord 6 in; gear reduction 7.8:1; tip speed 495 fps. Fuselage: metal and fabric-covered steel tube. Landing gear: conventional. Powerplant: Franklin 335 Model 6A4-150-B3.

PIASECKI Rescuer Model PV-3

TYPE: Transport, military; 10-place.

PERFORMANCE: Speed: maximum 120 mph at 2500 ft; cruising 85 mph at SL. Ceiling 12,000 ft. Cruising range 300 mi. Rate of climb (vertical) over 400 fpm; best rate of climb over 800 fpm.

SPECIFICATIONS: Length 48 ft; height 12 ft 6 in; rotor diameter 41 ft. Weight: empty 5000 lbs; gross 6900 lbs. Fuel capacity 100 gals. Rotors: tandem; three hinged blades per rotor; disc loading 2.67 psf; power loading 10.8 lbs/hp. Fuselage: fabric-covered steel tube. Landing



(Continued from page 85)

gear: tricycle. Powerplant: Pratt & Whitney Wasp Model H (R-1340).

NOTEWORTHY FEATURES

USN Model HRP-1. Tandem rotors permit high useful load, present minimum of fuselage drag and make possible large *cg* travel. Contra-rotating rotors permit all available power to be applied directly to lift.



PIASECKI Model HRP-2

TYPE: Transport; military; 10-place.

PERFORMANCE: Speed: maximum 105 *mph* at SL; cruising 85 *mph* at SL. Ceiling 11,000 ft. Cruising range 300 *mi.* Rate of climb (vertical) 350 *fpm* at SL; best rate of climb 800 *fpm* at SL.

SPECIFICATIONS: Length 54 ft; height 14 ft 10 in; rotor diameter 41 ft. Weight: empty 5054 *lbs*; gross 6978 *lbs*. Fuel capacity 100 *gals*. Rotors: tandem; three hinged blades per rotor. Fuselage: metal-covered aluminum alloy. Landing gear: tricycle. Powerplant: Pratt & Whitney Wasp Model H (R-1340-AN-1).

NOTEWORTHY FEATURES

Development of Model PV-3 (HRP-1) for Navy, with single tail and metal fuselage.

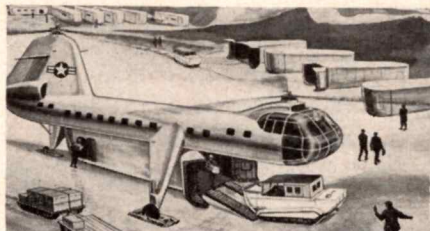
PIASECKI Transporter Model PV-15

TYPE: Transport, military.

SPECIFICATIONS: Rotors: tandem; three hinged blades per rotor. Fuselage: metal-covered aluminum alloy. Landing gear: conventional.

NOTEWORTHY FEATURES

USAF Model XH-16. To be largest helicopter ever built, with highest useful load and longest range. Dimensions will compare generally with



Douglas C-54 transport fuselage. Equipped with detachable capsule which will double the payload in "truck-trailer" operation. Configuration to be similar generally to Model PV-14. Development is joint USAF-USN project.



PIASECKI Retriever Model PV-14

TYPE: Passenger, utility, military; five-place.

PERFORMANCE: Speed: maximum 130 *mph* at SL; cruising 100 *mph* at SL. Ceiling 12,000 ft. Cruising range 400 *mi.* Rate of climb (vertical) 950 *fpm*; best rate of climb 1200 *fpm*.

SPECIFICATIONS: Length 31 ft 7 in; height 12 ft 6 in; rotor diameter 35 ft. Weight: empty 3966 *lbs*; gross 5355 *lbs*. Fuel capacity 100 *gals*. Rotors: tandem; three hinged blades per rotor. Fuselage: metal-covered aluminum alloy. Landing gear: conventional. Powerplant: Continental Model R-9A (R-975-34).

NOTEWORTHY FEATURES

US Navy Model HUP-1 (formerly XHJP-1).

PIASECKI Model PD-22C

TYPE: Rescue; transport, utility, military; 20-place.

SPECIFICATIONS: Length 54 ft; height 15 ft; rotor diameter 44 ft. Rotor: tandem; three hinged blades per rotor. Fuselage: metal-covered aluminum alloy. Landing gear: tricycle "omniphibious"; tread 13 ft 4 in. Powerplant: Wright Cyclone 9 (R-1820-76A).

NOTEWORTHY FEATURES

USAF Model H-21. Development of USN Model HRP-2. "Omniphibious" landing gear combines regular landing wheels, floats and skis into compact unit, with any one usable at pilot's will. Specifically designed for Arctic rescue operation by MATS Air Rescue Service. Cabin area 615 *cu ft*. Equipped with swinging hydraulic hoist over forward door and hydraulic boost system on all controls. Commercial version seats 15-21 passengers.



SIKORSKY Model S-51 T. C. H-2



TYPE: Passenger, military; four-place.

PERFORMANCE: Speed: maximum 103 *mph*, SL 3800 ft; cruising 85 *mph* at 1000 ft. Ceiling 5000 ft; cruising range 255 *mi.* Rate of climb (vertical) 200 *fpm* at SL; best rate of climb 1000 *fpm* at SL.

SPECIFICATIONS: Length 57 ft 8 in; height 12 ft 11 in; rotor diameter 49 ft. Weight: empty

3805 *lbs*; gross 5500 *lbs*. Fuel capacity 100 *gals*. Main rotor: single; three hinged, mechanically-feathering all-metal blades; disc loading 2.9 *psf*; power loading 12.2 *lbs/hp*; chord 16.4 in; gear ratio 12:1; tip speed 498 *fpm*. Tail rotor: two all-metal seesaw blades; diameter 8 ft 8 in; gear ratio 1.8:1; tip speed 580 *fpm*. Fuselage: metal-covered steel tube. Landing gear: tricycle. Powerplant: Pratt & Whitney Wasp Jr. Model B (R-985-B4).

NOTEWORTHY FEATURES

USAF H-5H, USN HO3S-1. Has over 110,000 *hrs* flight time. All-metal rotor blades have replaced fabric-covered main blades and wooden tail blades, with minor modification, and permit an increase of 200 *lbs* in gross weight with no performance change. Feature equipment includes radio, heater and defroster, direct-drive electric starter and auxiliary electric fuel pump. Military version equipped with rescue hoist, litter "bubbles" and amphibious landing gear.

SIKORSKY Model S-55 T. C. Pending



TYPE: Passenger, industrial, military; 12-place.

PERFORMANCE: Speed: maximum 110 *mph* at SL; cruising 86 *mph* at 1000 ft. Ceiling 5500 ft. Cruising range 470 *mi.* Rate of climb (vertical) 350 *fpm* at SL; best rate of climb 1130 *fpm* at SL.

SPECIFICATIONS: Length 41 ft 9 in; height 14 ft 8 in; rotor diameter 53 ft. Weight: empty 4200 *lbs*; gross 6800 *lbs*. Fuel capacity 190 *gals*. Main rotor: single; three hinged, mechanically-feathering, all-metal blades; disc loading 3.08 *psf*; power loading 11.3 *lbs/hp*. Tail rotor: two all-metal seesaw blades. Fuselage: aluminum and magnesium alloy. Landing gear: quadricycle. Powerplant: Pratt & Whitney Wasp Model H (R-1340).

NOTEWORTHY FEATURES

USAF Model H-19. Utility craft, which, used for rescue, can carry eight litters. Using auxiliary fuel, range is increased to 1000 *mi.* Can be loaded inside Fairchild C-82 or larger transport. All-metal amphibious landing gear is available.

SIKORSKY Model S-52-2 T. C. Pending

TYPE: Passenger, industrial-agricultural, military; four-place.

PERFORMANCE: Speed: maximum 118 *mph* at SL; cruising 92 *mph* at 1000 ft. Ceiling 4800 ft. Cruising range 415 *mi.* Rate of climb (vertical) 400 *fpm* at SL; best rate of climb 1100 *fpm* at SL.

SPECIFICATIONS: Length 39 ft; height 8 ft 8 in; rotor diameter 33 ft. Weight: empty 1650 *lbs*; gross 2600 *lbs*. Fuel capacity 62 *gals*. Main rotor: single; three hinged, all-metal mechanically-feathering blades; disc loading 3.04 *psf*; power loading 10.6 *lbs/hp*. Tail rotor: two all-metal seesaw blades. Fuselage: metal-covered aluminum alloy semi-monocoque. Landing gear: quadricycle. Powerplant: Franklin 425 Model 6V6-245-B16F.

NOTEWORTHY FEATURES

USAF Model H-18A. Differs from the S-52 prototype and S-52-1 production model in that cabin has been extended, fore and aft, to 120 *cu ft* capacity. Has maximum ferry range of over 800 *mi* with auxiliary fuel and can be loaded easily inside cargo transport. No photo available.

SEIBEL Model S-4

TYPE: Passenger, industrial-agricultural, military; two-place.

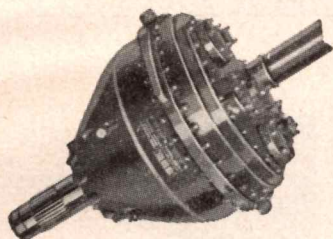
PERFORMANCE: Speed: maximum 70 *mph*; cruising 65 *mph*. Ceiling 10,000 ft. Cruising range 200 *mi.* Rate of climb (vertical) 200 *fpm* at SL; best rate of climb 800 *fpm*.

SPECIFICATIONS: Length 32 ft; height 10 ft; gross 1450 *lbs*. Fuel capacity 18 *gals*. Main rotor diameter 29 ft. Weight: empty 940 *lbs*;

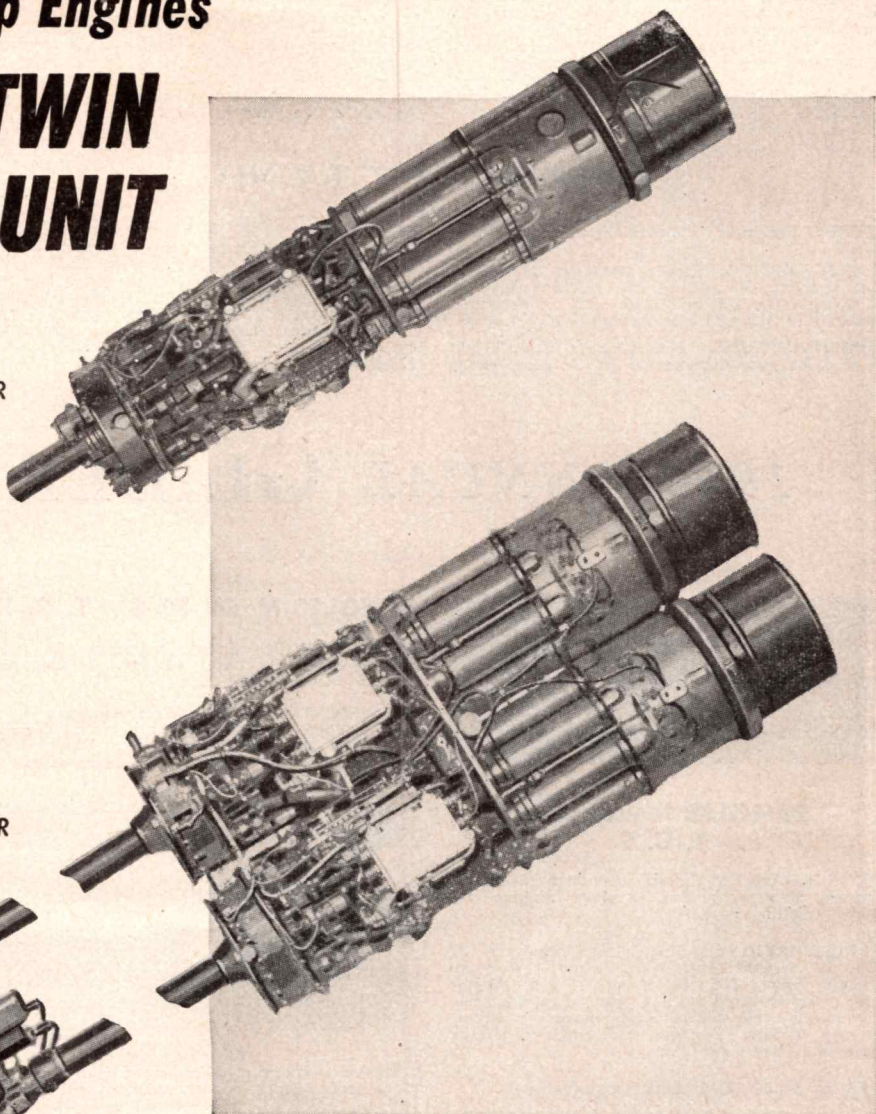
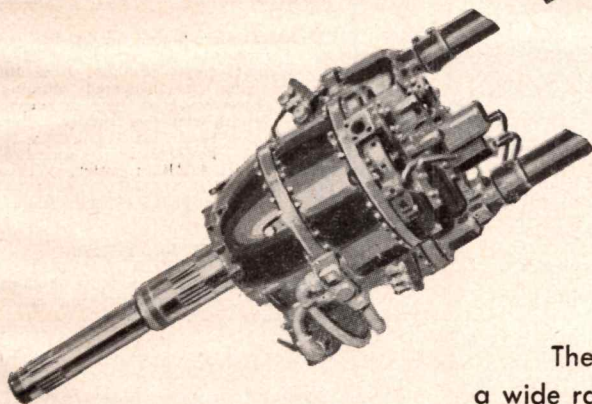
Allison Turbo-Prop Engines

SINGLE OR TWIN ONE BASIC UNIT

**T38 2750 HORSEPOWER
1250 LBS. WEIGHT**



**T40 5500 HORSEPOWER
2500 LBS. WEIGHT**



These two new versatile Allison Turbo-Prop engines cover a wide range of high power requirements for modern aircraft.

The basic unit is the single section T38 engine that develops 2750 horsepower and weighs only 1250 pounds. Two of these units, connected through a dual reduction gear, form one compact engine of 5500 horsepower—the Twin T40. Each is the smallest-size, lightest-weight propeller-type power plant of its horsepower in the world.

Thus, with either the single or twin engine, Allison brings for the first time the smooth, vibration-free advantages of high powered gas turbines to a broad range of current and future aircraft.

Builder of the famous J33 and J35 Turbo-Jet aircraft engines

Allison

DIVISION OF
INDIANAPOLIS, INDIANA



rotor: single; two fabric-covered seesaw wooden blades; disc loading 2.2 *psf*; power loading 12.6 *lbs/hp*; gear ratio 6.6:1; tip speed 590 *fpm*. Tail rotor: two fabric-covered, hinged wooden blades; diameter 5 ft 6 in; gear ratio 6.60:1; tip speed 510 *fpm*. Fuselage: steel-tube. Landing gear: tricycle. Powerplant: supercharged Lycoming O-235-C1.

PRICE: \$10,000 (FAF standard equipment).

NOTEWORTHY FEATURES

Supercharged engine for high-altitude performance, which is constant at any height from SL to 10,000 ft. Cargo space located on *c.g.* can accommodate one passenger or one litter and can be loaded from rear or either side.

UNITED Model UH-12 T. C. 6H-1

TYPE: Passenger, industrial-agricultural; three-place.

PERFORMANCE: Speed: maximum 84 *mph* at SL; cruising 76 *mph* at SL. Ceiling 8000 ft. Cruising range 200 mi. Rate of climb (vertical) 400 *fpm* at SL; best rate of climb 800 *fpm* at SL.

SPECIFICATIONS: Length 38 ft 8 in; height 9 ft 6 in; rotor diameter 35 ft. Weight: empty

1447 *lbs*; gross 2247 *lbs*. Fuel capacity 27 *gals*. Main rotor: single; two seesaw wooden blades; disc loading 2.3 *psf*; power loading 12.6 *lbs/hp*; chord 11 in; gear ratio 9.2:1; tip speed 600 *fpm*. Tail rotor: two hinged all-metal blades; diameter 5 ft 6 in; gear ratio 1.6:1; tip speed 550 *fpm*. Fuselage: aluminum alloy. Landing gear: tricycle. Powerplant: Franklin 335 Model 6V4-178-B33.



PRICE: \$19,995 (FAF standard equipment).

NOTEWORTHY FEATURES

Formerly designated as Hiller 360. Self-centering overhead stick permits "hands-off" flight, eliminates many rods, levers, pulleys and cables. Single-stage planetary transmission saves weight and reduces moving parts. Automatically coordinated throttle-pitch control.

1950 ANNUAL GLIDER DIRECTORY



BRIEGLER Model BG-6 T. C. 6

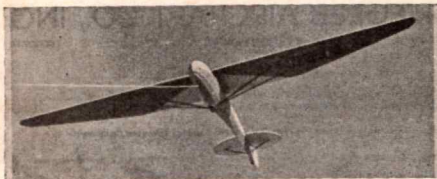
PERFORMANCE: Speed: maximum 72 *mph*; cruising 38 *mph*; landing 32 *mph*. Sinking rate 3 *fpm*. Gliding ratio 16:1.

SPECIFICATIONS: Single-place; wingspan 32 ft 3 in; length 18 ft 3 in; height 4 ft 3 in. Weight: empty 235 *lbs*; gross 425 *lbs*. Wing: high, fabric-covered wooden spar. Fuselage: fabric-covered steel tube. Fabric-covered ailerons, elevator, rudder. Landing gear: single wheel and nose skid; tire size 12 in.

PRICE: \$1075 (FAF standard equipment)

NOTEWORTHY FEATURES

High-performance utility glider, designed for airplane tow and primary soaring. Available in kit form.



BRIEGLER Model BG-7 T. C. Pending

PERFORMANCE: Speed: maximum 82 *mph*; cruising 50 *mph*; landing 38 *mph*. Sinking rate 3.1 *fpm*. Gliding ratio 20:1.

SPECIFICATIONS: Single-place; wingspan 40 ft 3 in; length 18 ft 3 in; height 3 ft 3 in. Weight: empty 250 *lbs*; gross 500 *lbs*. Wing: high, fabric-covered wooden spar. Fuselage: fabric-covered steel tube. Fabric-covered ailerons, elevator, rudder, metal-covered spoilers. Landing gear: single wheel and nose skid; tire size 12 in.

PRICE: \$1275 (FAF standard equipment).

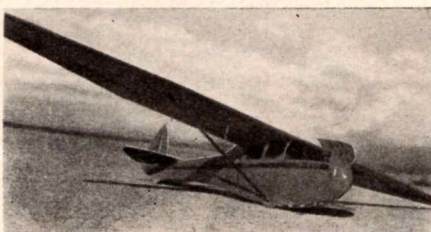
NOTEWORTHY FEATURES

Tapered, high-performance sailplane wings, interchangeable with Model BG-6. Equipped with battery and lighting equipment and has 2-cu ft baggage compartment. Available in kit form.

BRIEGLER Model BG-8 T. C. 13

PERFORMANCE: Speed: maximum 90 *mph*; cruising 54 *mph*; landing 44 *mph*. Sinking rate 3.5 *fpm*. Gliding ratio 25:1.

SPECIFICATIONS: Two-place; wingspan 50 ft 4 in; length 22 ft 11 in; height 5 ft 4 in. Weight: empty 600 *lbs*; gross 1020 *lbs*. Wing: high, wood-covered wooden spar. Fuselage: wood-cov-

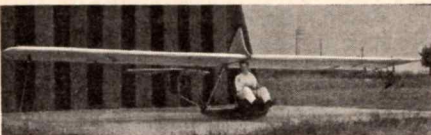


ered semi-monocoque. Wood-covered ailerons, fabric-covered elevator, rudder, metal-covered spoilers. Landing gear: single wheel and nose skid; tire size 14 in; shock absorber tennis balls.

PRICE: \$2995 (FAF standard equipment).

NOTEWORTHY FEATURES

High-performance sailplane, holding national altitude record for two-place craft. Designed for airplane tow, instruction, night and instrument flying. Equipped with battery and lighting equipment and has 3-cu ft baggage compartment. Available in kit form.



McFARLAND Model PT-4

PERFORMANCE: Speed: maximum 55 *mph*; cruising 30 *mph*; landing 20 *mph*. Sinking rate 4 *fpm*. Glide ratio 10.9:1.

SPECIFICATIONS: Single-place; wingspan 32 ft 7 in; length 18 ft 1 in; height 6 ft 11 in. Weight: empty 240 *lbs*; gross 410 *lbs*. Wing: high; fabric-covered wooden spar. Warren truss. Fabric-covered ailerons, elevator, rudder. Landing gear: wooden runner and wing-tip skids. Fuselage: open, wooden Warren truss.

PRICE: \$395 (FOB factory, crated, standard equipment).

NOTEWORTHY FEATURES

Specifically designed for home-workshop construction. Development of Model MPTG-3 primary training glider. Available in kit form.



NELSON Hummingbird Model PG-185

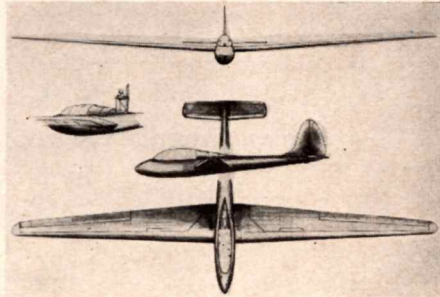
PERFORMANCE: Speed: maximum 125 *mph*; cruising 60 *mph*; landing 40 *mph*. Sinking rate 3.2 *fpm*. Gliding ratio 20:1. Rate of climb (power) 275 *fpm*.

SPECIFICATIONS: Two-place, side-by-side powered glider. Wing span 54 ft; length 22 ft; height 9 ft. Weight: empty 650 *lbs*; gross 1000 *lbs*. Wing: midwing, metal-covered aluminum spar. Fuselage: wood-covered semi-monocoque. Fabric-covered ailerons, elevator, rudder. Landing gear: tricycle; tire sizes 12 x 4 and 10 x 3 3/4; shock absorber oleo. Powerplant: Nelson H-54; propeller U. S. Model 42RB21; battery Willard.

PRICE: Approximately \$5000 (FAF standard equipment).

NOTEWORTHY FEATURES

Auxiliary-powered sailplane embodying high-performance design. Completely retractable engine, propeller and landing gear.



NELSON Hummingbird Model PG-185A

PERFORMANCE: Speed: maximum 125 *mph*; cruising 65 *mph*; landing 38 *mph*. Sinking rate 3.2 *fpm*. Gliding ratio 25:1. Rate of climb (power) 300 *fpm*. Fuel consumption 3.5 *gph*.

SPECIFICATIONS: Two-place, tandem, powered glider. Wingspan 54 ft; length 24 ft; height 7 ft 8 in. Weight: empty 650 *lbs*; gross 1050 *lbs*. Wing: midwing, metal-covered aluminum spar. Fuselage: wood-covered monocoque. Fabric-covered ailerons, elevator, rudders. Landing gear: tricycle; tire sizes 12 x 4 and 10 x 3 3/4; shock absorber oleo. Powerplant: Nelson H-59; propeller U. S. Model 42RB-21; battery Willard; radio Lear. (Continued on page 90)

**If You Have a Tough
Connector Problem, Ask
BREEZE**

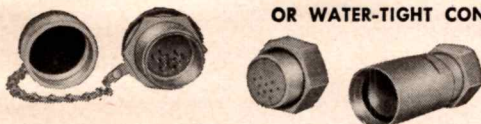
FOR THE ANSWER !

SPECIAL CONNECTORS

**for advanced radar
and electronic equipment**

Where electrical connector requirements are strict, or the job specialized, take advantage of Breeze experience. Breeze has engineered such advantages as removable contacts for panel-type connectors. This exclusive feature greatly simplifies wiring and maintenance, and is typical of advanced Breeze design.

PRESSURE-SEALED OR WATER-TIGHT CONNECTORS

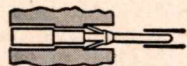


Engineered to specification in aluminum, brass, or steel. All sizes, capacities. High voltage pulse type connectors. Also rotary shaft seals and allied equipment. Write for details.

REMOVABLE CONTACTS

Save Time, Trouble, Confusion

Simple tool (right) removes contacts for bench soldering. Production time reduced, close work eliminated, errors avoided. Contacts simply snap back into block.



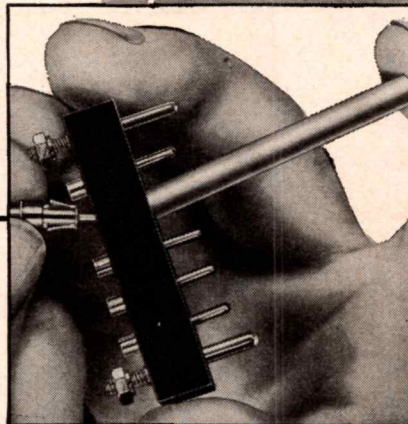
Contact retained securely in block by two spring locks.



Tubular tool inserted from contact side to close springs.

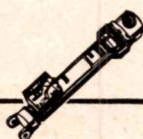


Contact easily removed, but cannot come loose in service.



BREEZE "Monobloc Miniatures" (above) come in 5, 10, 15, and 20 contact sizes or multiples thereof. Capacity—10 amperes with 7 millivolt drop; 500 volts DC or 275 volts AC.

Other Breeze Precision Products



ACTUATORS: All types, sizes. Complete control systems engineered to requirements. Above: Landing gear actuator, Fairchild Packet.



RADIO SHIELDING: For any type of high or low tension system. New type "unit leads" or re-wirable leads. Flexible shielded conduit.



"AERO-SEAL" Worm-Drive Hose Clamps. Vibration proof, uniform clamping, use again and again. Cadmium plated or stainless steel.

LOOK TO THE



FOR QUALITY

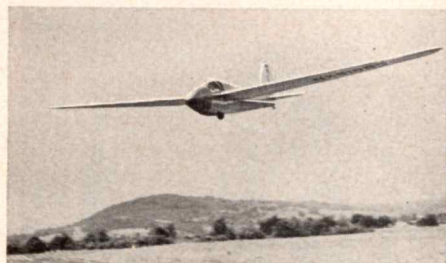
**BREEZE
CORPORATIONS, INC.**

41-E South Sixth Street Newark 7, New Jersey

PRICE: Approximately \$5500 (FAF standard equipment).

NOTEWORTHY FEATURES

Same design as Model PG-185, but with tandem seating. Completely retractable engine, propeller and landing gear. Fixed bicycle gear optional. NACA all-movable horizontal tail surfaces. Suitable trailer available for highway transport.



SCHWEIZER Model 1-23 High Performance Sailplane T. C. 1-G-1

PERFORMANCE: Speed: maximum 123 mph; cruising 75 mph; landing 32 mph.

SPECIFICATIONS: Single-place; wingspan 43 ft 10 in; length 20 ft 4 in; height 6 ft 10 in. Weight: empty 380 lbs; gross 550 lbs. Wing: midwing, metal-covered aluminum spar. Fuselage: metal-covered semi-monocoque. Metal-covered ailerons, elevator, rudder, spoilers. Landing gear: single wheel; tire size: 5.00 x 4.

PRICE: \$2195 (FAF standard equipment).

NOTEWORTHY FEATURES

Class I sailplane constructed of 75ST alloy and 24ST Alclad. Stable in stalls, it must be forced into spins, recovers easily with rudder. Spoilers give excellent glide control and are on same control as brake. Molded Lucite canopy, roomy cockpit with space for oxygen equipment.

STEINHAUSER Model MU-1 Midwest Utility Glider T. C. 16

PERFORMANCE: Speed: maximum 80 mph; cruising 30 mph; landing 24 mph.

SPECIFICATIONS: Single-place; wingspan 36 ft; length 19 ft 8 in; height 4 ft 5 in. Weight: empty 300 lbs; gross 513 lbs. Wing: high, fabric-covered wooden spar. Fuselage: fabric-covered steel tube. Fabric-covered ailerons, elevator, rudder. Landing gear: single wheel; tire size: 5.00x4. Brake mechanical.

\$975 (FAF standard equipment)

Zeder SAE President

JAMES C. ZEDER, chairman of the Engineering Board of the Chrysler Corp., has been elected president of the Society of Automotive Engineers for 1950.

Aviation officers elected by the Society for 1950 are Raymond D. Kelly, United Air Lines, vice-president, air-transport activity; Harold D. Hoekstra, CAA, vice-president, aircraft activity; and Wright A. Perkins, Pratt & Whitney Aircraft, vice-president, aircraft-powerplant activity.

New Burndy Plant

BURNDY CANADA LTD., a subsidiary of Burndy Engineering Co., Inc., New York, has opened a new factory at 381 Greenwood Ave., Toronto. The modern two-story plant will be devoted to the manufacture of Burndy electrical connectors and other electrical specialties for use in Canada.

SCHWEIZER Model SGU 1-19 Utility Training Glider T. C. 17

PERFORMANCE: Speed: maximum 83 mph; cruising 75 mph; landing 28 mph.

SPECIFICATIONS: Single-place; wing span 36 ft 8 in; length 20 ft 7 in; height 8 ft 8 in. Weight: empty 320 lbs; gross 550 lbs. Wing: high, fabric-covered wooden spar, aluminum-covered leading edge. Fuselage: fabric-covered steel tube. Fabric-covered ailerons, elevator, rudder, spoilers. Landing gear: single wheel; tire size 6.00 x 6.

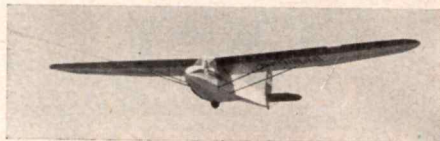
PRICE: \$1125 (FAF standard equipment).

SCHWEIZER Model SGU 2-22 Utility Training Sailplane T. C. 18



PERFORMANCE. Speed: maximum 89 mph; cruising 80 mph; landing 28 mph.

SPECIFICATIONS: Two-place; wingspan 43 ft;



NOTEWORTHY FEATURES

Equipped with Schweizer Quick Release Hook, with safety feature for towing. Craft has flown over 30 mi cross-country, has soared to 5000-ft altitudes and has made duration flights in excess of 5 hrs.

PRICE: \$1745 (FAF standard equipment)

NOTEWORTHY FEATURES

Utility sailplane, with low sinking rate and flat glide angle. Has been soared to more than 6000 ft, gone cross-country for over 50 mi. and has remained aloft in flight for more than 10 hrs. Highly spin-resistant.

STEINHAUSER Model MI-1

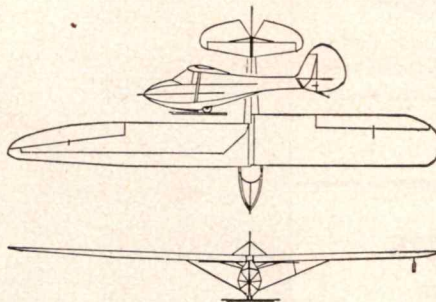
Midwest Sailplane

T. C. Pending

PERFORMANCE: Speen: maximum 80 mph; cruising 35 mph; landing 28 mph.

SPECIFICATIONS: Single-place; wingspan 46 ft; length 19 ft 8 in; height 4 ft 6 in. Weight: empty 330 lbs; gross 535 lbs. Wing: fabric-covered wooden spar. Fuselage: fabric-covered steel tube. Fabric-covered ailerons, elevator, rudder. Landing gear: single wheel; tire size: 5.00x4. Brake: mechanical.

PRICE: \$1475 (FAF standard equipment)



NOTEWORTHY FEATURES

Fuselage and empennage same as Model MU-1. Wings are interchangeable.

Sperry Army Contract

SPERRY GYROSCOPE CO. has received the largest peacetime order in its history in a contract from the U.S. Army Ordnance Dept. calling for quantity production of a new and highly-complex anti-aircraft gunfire-control system.

Development of this equipment was initiated by Sperry prior to the end of World War II. Part of the program included the production of pilot models in the Sperry engineering laboratories.

Kaiser Aluminum

THE PERMANENTE METALS CORP. has changed its corporate name to Kaiser Aluminum & Chemicals Corp. for closer identification with its principal products. The corporation's wholly owned sales subsidiary, Permanente Products Co., is renamed Kaiser Aluminum & Chemical Sales, Inc.

Officers and directors reelected at the annual meeting were Henry J. Kaiser, president and director; E. E. Trefethen, Jr., executive vice-president and director; Edgar F. Kaiser, vice-president; D. A. Rhoades, vice-president, general manager and director; G. G. Sherwood, vice-president, secretary-treasurer and director; Chad F. Calhoun, vice-president; Donald Browne, comptroller; Harvey N. Black, Paul S. Marrin, Gil J. Shea, Frank F. Walker and W. G. Swigert, directors.

Douglas In East

DOUGLAS AIRCRAFT CO. announces the opening of a sales office at 247 Park Ave., New York, to expand parts sales and service representations to airlines, their representatives and offices on the Atlantic coast.

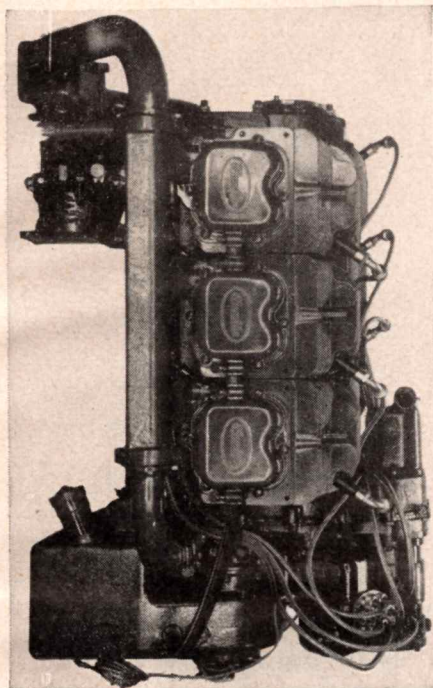
It will be in charge of David Downey, transferred from the company's main office at Santa Monica.

Brazil Honors PAA

PAN AMERICAN WORLD AIRWAYS has been honored by the Brazilian Government for its contribution to the "development of Brazilian air transport" and the establishment of the first Brazilian civil air service to Europe, with the presentation of the Order of the Southern Cross to PAA vice-president Erwin Balluder.

Balluder is the fourth PAA executive to receive this honor.

1950 Annual Directory of AIRCRAFT PISTON ENGINES



AIRCOOLED MOTORS

Franklin 335 Vertical T. C. 244 Model 6V4-178-B32

TYPE: 6-cyl horizontal opposed; air-cooled; direct drive.

PERFORMANCE: Takeoff hp 178; takeoff rpm 3000.

SPECIFICATIONS: Displacement 335 cu in; bore 4.5 in; stroke 3.5 in; comp. ratio 7.0:1. Fuel grade 80 octane; oil viscosity SAE 40; wet sump. Dry weight 308 lbs; height 38 $\frac{7}{8}$ in; width 31 $\frac{3}{4}$ in; length 30 $\frac{3}{4}$ in. Carburetor: Marvel MA4-5 float-type or Bendix-Stromberg PS5-C pressure type. Magnetos: Scintilla S6RN21; shielded ignition optional. Starter and generator, Delco-Remy; fuel pump, a-c.

NOTEWORTHY FEATURES

Designed especially for helicopter installations; engine operates with the crankshaft vertical. The lubricating system is self-contained. A flanged crankshaft end is provided for the power takeoff. Models 6V4-178-B32 and 6V4-178-B33 are not provided with cooling equipment. Model 6V4-165-B32F is furnished with axial-flow cooling fan. Standard equipment includes 12-v electric starter with starting solenoid; 12-v generator with automatic voltage regulator; dual magnetos ignition; either float-type with manual mixture control and idle cut-off, or pressure-type carburetor; diaphragm-type fuel pump. Weight includes starter and generator. Standard installation in Bell Helicopter Model 47, Sikorsky Model S-52 and United Helicopter Model Hiller 360.

AIRCOOLED MOTORS

Franklin 335 Vertical T. C. 244 Model 6V4-200-C32

TYPE: 6-cyl horizontal opposed; air-cooled; direct drive.

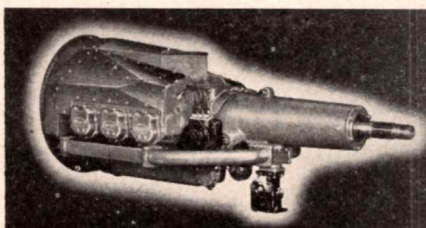
PERFORMANCE: Takeoff hp 200 at rpm 3100.

SPECIFICATIONS: Displacement 335 cu in; bore 4.5 in; stroke 3.5 in; comp. ratio 8.5:1. Fuel grade 91 octane; oil viscosity SAE 40; wet sump. Dry weight 333 lbs; height 38 $\frac{7}{8}$ in; width 31 $\frac{3}{8}$ in; length 30 in. Carburetor either Marvel

MA4-5 float-type or Bendix PS5-C pressure-type. Scintilla S6RN21 magnetos; shielded ignition optional. Starter and generator, Delco-Remy; fuel pump, a-c or Weldon.

NOTEWORTHY FEATURES

Designed especially for helicopter installations. Engine operates with the crankshaft vertical. Lubricating system is self-contained. A flanged crankshaft end is provided for the power takeoff. Light weight per hp. Standard equipment includes 12-v electric starter with starting solenoid, 12-v generator with voltage regulator, dual magneto ignition, either float-type with manual mixture control and idle cut-off or pressure-type carburetor. Diaphragm- or positive-displacement type fuel pump.



AIRCOOLED MOTORS

Franklin 500 Model 6A8-215-B8F T. C. 242

TYPE: 6-cyl horizontal opposed; air-cooled; direct drive.

PERFORMANCE: Takeoff hp 215 at 2500 rpm; cruising hp 160 at 2270 rpm.

SPECIFICATIONS: Displacement 500 cu in; bore 5.0 in; stroke 4.25 in; comp. ratio 7.0:1. Fuel grade 80 octane; oil viscosity SAE 40; wet sump. Dry weight 487 lbs; height 27 $\frac{1}{8}$ in; width 34 in; length 66 $\frac{1}{8}$ in. Carburetor: Marvel MA4-5 float-type or Bendix-Stromberg PS5-C pressure-type. Magnetos: Scintilla 6SL(R) N-31; shielded ignition optional; starter and generator, Auto-Lite; fuel pump, a-c.

NOTEWORTHY FEATURES

Weight includes starter, generator, oil cooler and cooling fan. Cooled by means of a direct-drive fan; special propeller-shaft extension permits propeller to be farther aft than normal, complete, packaged powerplant lends itself to an efficient pusher installation. Operating at crankshaft speed, the axial-flow fan takes care of the entire cooling requirement. Attached to the crankshaft, it is an integral part of the engine.

AIRCOOLED MOTORS

TYPE: 6-cyl horizontal opposed; air-cooled; direct drive.

PERFORMANCE: Takeoff hp 165 at 2800 rpm; cruising hp 125 at 2550 rpm.

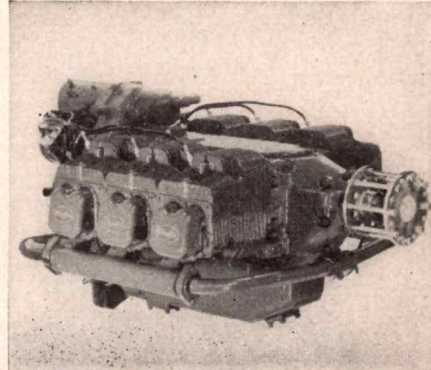
SPECIFICATIONS: Displacement 335 cu in; bore 4.5 in; stroke 3.5 in; comp. ratio 7.0:1. Fuel grade 80 octane; oil viscosity SAE 40; wet sump. Dry weight 324 lbs; height 25 $\frac{1}{4}$ in; width 31 $\frac{3}{8}$ in; length 37 $\frac{1}{4}$ in. Carburetor: Marvel MA4-5 float-type or Bendix-Stromberg PS5-C pressure-

AIRCOOLED MOTORS

TYPE: 6-cyl horizontal opposed; air-cooled; geared drive.

PERFORMANCE: Takeoff hp 185 at 3100 rpm; cruising hp 140 at 2820 rpm.

SPECIFICATIONS: Displacement 335 cu in; bore 4.5 in; stroke 3.5 in; comp. ratio 7.5:1. Fuel grade 80 octane; oil viscosity SAE 40; wet sump. Dry weight 369 lbs; height 26 $\frac{3}{8}$ in. Carburetor: either Marvel MA4-5 float-type or Bendix PS5-C



AIRCOOLED MOTORS

Franklin 335 Model 6A4-150-B3 T. C. 238

TYPE: 6-cyl horizontal opposed; air-cooled; direct drive.

PERFORMANCE: Takeoff hp 150 at 2600 rpm; cruising hp 113 at 2350 rpm.

SPECIFICATIONS: Displacement 335 cu in; bore 4.5 in; stroke 3.5 in; comp. ratio 7.0:1. Fuel grade 80 octane; oil viscosity SAE 40; wet sump. Dry weight 321 lbs; height 25 $\frac{3}{8}$ in; width 31 $\frac{3}{8}$ in; length 37 $\frac{3}{8}$ in. Carburetor: Marvel MA-3SPA float-type. Magnetos: Eisemann LA-6 or Scintilla S6RN21; shielded ignition optional. Starter and generator, Delco-Remy; fuel pump, a-c.

NOTEWORTHY FEATURES

Weight includes starter, generator, oil cooler and propeller attaching parts. Two-piece aluminum crankcase, split vertically, with removable oil pan. Cylinders comprise a one-piece aluminum alloy casting. Nickel-iron cylinder liner is replaceable for service. Hydraulic valve lifters contribute toward a smooth, quiet valve-actuating mechanism; valve-rocker mechanism is internally lubricated. Oil pressure-relief valve is located on the outside of the crankcase for easy servicing.

Standard equipment includes: 12-v electric starter with starting solenoid; 12-v 25-amp generator with automatic voltage regulator; dual magneto ignition; float-type carburetor with manual mixture control and idle cut-off; oil cooler. Standard installation in Stinson 150 and Bellanca Cruisair.

Franklin 335 Model 5A4-165-B3 T. C. 238

type. Magnetos: Eisemann LA-6 or Scintilla S6RN21; shielded ignition optional. Starter and generator, Delco-Remy; fuel pump, a-c.

NOTEWORTHY FEATURES

Weight includes starter, generator, oil cooler and propeller attaching parts. Features as shown for Model 6A4-150-B3 with additional fact that this model is approved with both float- and pressure-type carburetors. Standard installation in Stinson Voyager and Flying Station Wagon.

Franklin 335 Model 6AG4-185-B12 T. C. 238

pressure-type. Scintilla S6RN21 magnetos; shielded ignition optional. Starter and generator, Delco-Remy; fuel pump, a-c.

NOTEWORTHY FEATURES

Weight includes starter, generator, oil cooler and propeller attaching bars. Features as shown for Model 6A4-165-B3 with exception that this model is equipped with a gear reduction unit with a ratio of 0.632:1.

WHAT'S DOING

We've just been reviewing some figures to see what happened at Pratt & Whitney Aircraft during 1949.

One thing that happened was that we continued to build and deliver substantial quantities of aircraft engines. During the year, we were in production on six basic sizes of piston engines for both military and commercial use. As you know, we also swung into production on our first jet engine, the Turbo-Wasp. All told, we shipped more than 2,400 engines in 1949.

There was a lot of work, a lot of planning, and a lot of headaches involved in this manufacturing accomplishment. On the piston engines, for example, quantity orders by our customers for various models of engines fluctuated abnormally during the year, requiring repeated revision of our production schedules. Then too, we made thousands of design improvements in these production models, requiring new tooling and changes in manufacturing methods. On the jet engines, of course, we were plagued by all the inevitable troubles involved in putting any completely new product into production. Despite the problems, we delivered almost 7,000,000 horsepower in engines, and the equivalent of 40% additional horsepower in spare parts.

But the physical production of engines wasn't the only thing that happened at Pratt & Whitney during 1949. In fact, there wouldn't have been *any* production if those engines hadn't possessed the superior performance characteristics and the dependability that brought orders from our customers. So, an intensive engineering program of research, design, development and test has always been the mainstay of our progress at Pratt & Whitney. Out of it has already come the improved performance of our current types of engines. And out of it will soon come still better Pratt & Whitney engines to meet the rapidly advancing requirements of both military and commercial operators.

at Pratt & Whitney Aircraft?

HOW MUCH ENGINEERING WORK DID WE DO LAST YEAR?

- ☐ 1 Million Man-Hours?
- ☐ 2 Million Man-Hours?
- ☐ 3 Million Man-Hours?
- ☐ ? Million Man-Hours?



Last year, Pratt & Whitney engineers put in a total of nearly 3,000,000 man-hours of work. That's equivalent to the full time of one man working 50 weeks a year for 1,500 years! Actually, of course, no one man could ever do the work if he lived a million years. The engineering problems are so complex and varied that our engineering staff consists of designers, draftsmen, mathematicians, metallurgists, physicists and countless other specialists, each contributing his technical knowledge and skill to the solution of some part of the problems. To all this time and effort must then be added more millions of man-hours by expert craftsmen, working directly for the engineering department to fabricate, assemble and test the experimental parts and engines required for new designs.

HOW MUCH EXPERIMENTAL TESTING DID WE DO IN 1949?

- ☐ 10,000 Hours?
- ☐ 18,000 Hours?
- ☐ 52,000 Hours?
- ☐ 70,000 Hours?



Every time a new part is designed, we have to make sure it will function properly. Every time we change an existing part we have to find out if the change produces the desired improvement. And every time operating troubles develop in service, we have to find out the source of the trouble. This involves a continuous program of experimental testing both of individual parts and of completed engines. In addition to almost a thousand hours of flight testing, we carried out, last year, more than 70,000 hours of such experimental testing. This included more than 18,000 hours of testing of full-scale experimental engines and more than 50,000 hours of test-stand running of major components such as cylinders, burners, turbines and compressors.

HOW MANY DESIGN CHANGES WERE MADE DURING THE YEAR?

- ☐ 3,831?
- ☐ 11,417?
- ☐ 19,000?
- ☐ 52,000?



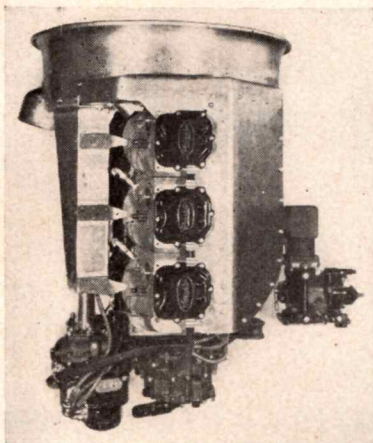
The design of an aircraft engine is never finished until that engine becomes obsolete and goes out of production. It must be constantly refined and improved — either to provide better performance, or to reduce manufacturing time and cost, or to correct troubles encountered in actual service. Just as an example, we made 3,831 engineering changes on production models of Pratt & Whitney engines during 1949 — an average of 15 changes every working day. This involved changing more than 19,000 drawings. And these are only the changes that applied to production models of engines. Beyond this, the engineering department changed an additional 11,417 drawings applying to experimental engines. Add to these figures the 21,999 brand-new drawings and design layouts turned out for experimental engines, and you get a grand total of more than 52,000 drawings that were either made or changed during the year — an average of more than 1,000 every week.



**PRATT & WHITNEY
AIRCRAFT**

EAST HARTFORD, CONNECTICUT

ONE OF THE FOUR DIVISIONS OF UNITED AIRCRAFT CORPORATION



AIRCOOLED MOTORS Franklin 425 Model 6V6-2450B16F T. C. 258

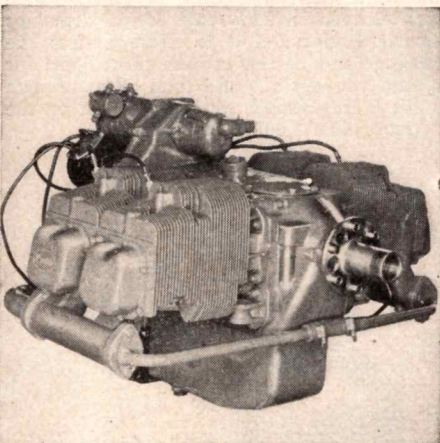
TYPE: 6-cyl horizontal opposed; air-cooled; direct drive.

PERFORMANCE: Takeoff hp 245 at 3275 rpm.

SPECIFICATIONS: Displacement 425 cu in; bore 4.75 in; stroke 4 in; comp. ratio 7.5:1. Fuel grade 80 octane; oil viscosity SAE 50; wet sump. Dry weight 353 lbs; height 38 in; width 33 3/8 in; length 39 7/8 in. Pressure-type carburetor, Bendix PS-7. Eisemann LA-6 magnetos; shielded ignition optional.

NOTEWORTHY FEATURES

An extremely lightweight engine developed for helicopter use; 1.44 lbs per hp. Engine operates with crankshaft vertical. Lubrication system is wet-sump and self-contained. Two-piece aluminum crankcase split vertically; cylinders are one-piece aluminum with replaceable iron-cylinder liners. Hydraulic valve lifters contribute toward a smooth, quiet valve-actuating mechanism.



AIRCOOLED MOTORS Franklin 225 Model 4A4-100-B3 T. C. 239

TYPE: 4-cyl horizontal opposed; air-cooled; direct drive.

PERFORMANCE: Takeoff hp 100 at 2550 rpm; cruising hp 75 at 2320 rpm.

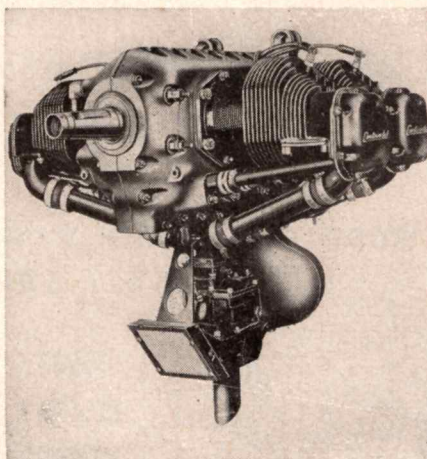
SPECIFICATIONS: Displacement 225 cu in; bore 4.5 in; stroke 3.5 in; comp. ratio 7.0:1. Fuel grade 80 octane; oil viscosity SAE 40; wet sump. Dry weight 230 lbs; height 27 1/8 in; width 31 1/2 in; length 27 1/8 in. Carburetor: Marvel MA-3SPA float type. Magnetos: Eisemann LA-4; shielded ignition optional. Starter and generator, Delco-Remy or Auto-Lite; fuel pump, AC.

NOTEWORTHY FEATURES

Weight includes starter, generator and propeller attaching parts. Two-piece aluminum crankcase, split vertically, with removable oil pan. Cylinders comprise a one-piece aluminum-alloy casting. Nickel-iron cylinder liner is replaceable for service. Hydraulic valve lifters contribute toward a

smooth, quiet valve-actuating mechanism. Valve-rocker mechanism is internally lubricated. Oil pressure-relief valve is located on the outside of the crankcase for easy servicing.

Standard equipment includes: 12-v electric starter with starting solenoid; 12-v, 15-amp generator with automatic voltage regulator; dual magneto ignition; float type carburetor with manual mixture control and idle cut-off.



CONTINENTAL Model A65-8 T. C. 205

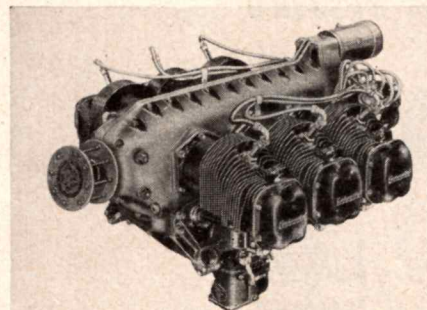
TYPE: 4-cyl horizontal opposed; air-cooled, direct drive.

PERFORMANCE: Takeoff hp 65 at 2300 rpm; cruising hp 53 at 2150 rpm.

SPECIFICATIONS: Displacement 171 cu in; bore 3.875 in; stroke 3.625 in; compression ratio 6.3:1. Dry weight 176 lbs (without starter); width 31.50 in; length 31 in. Fuel grade 73, oil viscosity SAE 30 and 40; wet sump. Carburetor: Stromberg NA-S3B float type. Magnetos: Eisemann AM-4 or J. I. Case 4-CAM; fuel pump, none; a-c optional at extra cost.

NOTEWORTHY FEATURES

Installed in Piper J-3 Cub, Aeronca Champion, Aeronca Chief, Taylorcraft Standard, Taylorcraft Custom, Luscombe Silhouette, Companhia Aeronautica Paulista CAP-4 (Brazil), Cub Aircraft Corp., Ltd., Cub (Canada). Weight is without starter.



CONTINENTAL Model C145-2 T. C. 253

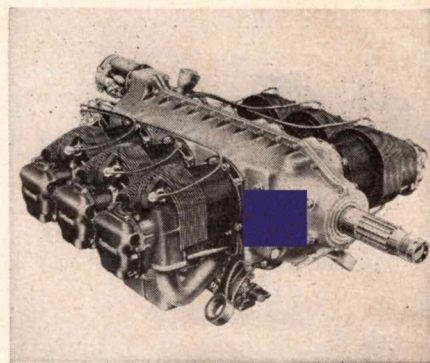
TYPE: 6-cyl horizontal opposed, air-cooled, direct drive.

PERFORMANCE: Takeoff hp 145; cruising hp 105, takeoff rpm 2700; cruising rpm 2410.

SPECIFICATIONS: Displacement 301 cu in; bore 4.062 in; stroke 3.875 in; comp. ratio 7.0:1; fuel grade 80 octane; oil viscosity SAE 30 & 40; lubrication wet sump; dry weight 265 lbs; width 31.5 in; length 41 in; carburetor Marvel MA-3SPA float-type; magnetos Bendix SF6LN-12; shielded ignition; starter and generator Delco-Remy.

NOTEWORTHY FEATURES

Installed in Cessna 170. Weight is without starter.



CONTINENTAL Models E165, E185 T. C. 246

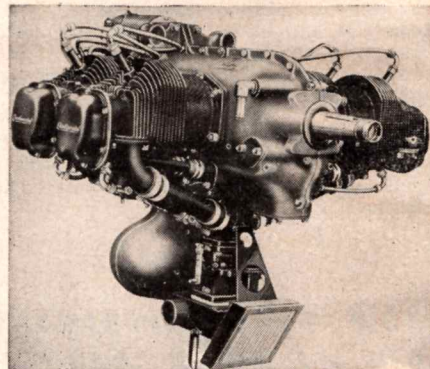
TYPE: 6-cyl horizontal opposed; air-cooled; direct drive.

PERFORMANCE: Takeoff (E165) hp 165 at 2050 rpm, (E185) hp 185 at 2300 rpm; cruising (E165) hp 124. Recommended cruising (E165) rpm 1850, (E185) rpm 2075.

SPECIFICATIONS: Displacement 471 cu in; bore 5.0 in; stroke 4.0 in; comp. ratio 7.0:1; fuel grade 80/87 octane; oil viscosity SAE 30 & 40; lubrication wet sump; dry weight 344 lbs; width 33.4 in; length 35.5 in; carburetor Marvel MA-4-5 float-type; magnetos Bendix S6LN-21; shielded ignition; starter and generator Delco-Remy; fuel pump Romed.

NOTEWORTHY FEATURES

Used in Luscombe Aircraft. Weight is without starter.



CONTINENTAL Models C75-12, C85-12 (-8F) T. C. 233

TYPE: 4-cyl horizontal opposed; air-cooled; direct drive.

PERFORMANCE: Takeoff (C75-12) hp 85 at 2575 rpm; (rated 75 hp at 2275 rpm). Takeoff (C85-12) and (C85-8F) hp 90 at 2850 rpm; (rated 85 hp at 2575).

SPECIFICATIONS: Displacement 188 cu in; bore 4.062 in; stroke 3.625 in; compression ratio 6.3:1. Dry weight (C75-12) and (C85-12) 184 lbs; (C85-8F) 176 lbs; width (C75-12) and (C85-12) 31.60 in; (C85-8F) 31.50 in; length (C75-12) and (C85-12) 32 in; (C85-8F) 31 in. Fuel grade 73; oil viscosity SAE 30 and 40; wet sump. Carburetor: Stromberg NA-S3A1, float type. Magnetos: Scintilla S4LN-21. Starter and generator, Delco-Remy; except (C85-8F) which has no starter; fuel pump, a-c.

NOTEWORTHY FEATURES

Installed in Luscombe Silhouette, Funk B, Cessna 120 and 140, Commonwealth Skyraider. Weight is without starter.

CONTINENTAL Model E185-1 T. C. 246

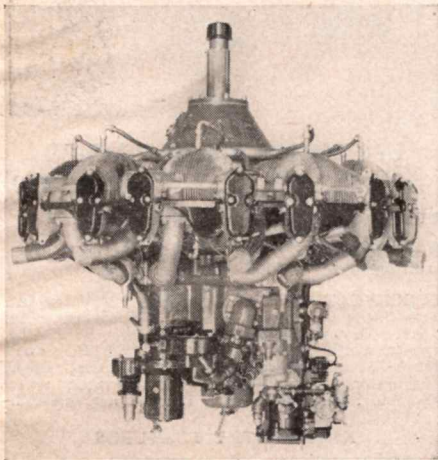
TYPE: 6-cyl horizontal opposed; air-cooled; direct drive.

PERFORMANCE: Takeoff hp 185; cruising hp 139; takeoff rpm 2300.

SPECIFICATIONS: Displacement 471 cu in; bore 5.0 in; stroke 4.0 in; comp. ratio 7.0:1. Fuel grade 80 octane; oil viscosity SAE 30 & 40; lubrication dry sump; dry weight 318 lbs; width 33.4 in; length 47.3 in; carburetor Bendix PS-5C pressure-type; Magnetos Bendix S6LN-21 shielded ignition; starter Delco-Remy; generator Delco-Remy; fuel pump Rmec.

NOTEWORTHY FEATURES

Model E185-8 same as E185-1 except that it has Eclipse direct-cranking starter. Used in Beech Bonanza. Model E185-3 is similar but has a wet sump, weighs 326 lbs and has Carter fuel pump. Used in Ryan Navion.



CONTINENTAL Model R-975 T. C. 162

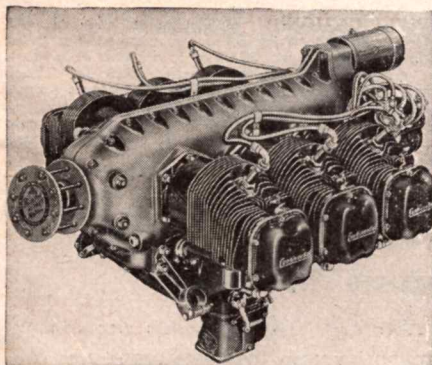
TYPE: 9-cyl radial; direct drive.

PERFORMANCE: Takeoff hp 525 at 2300 rpm; cruising hp 350 at 2225 rpm.

SPECIFICATIONS: Displacement 973 cu in; bore 5 in; stroke 5.50 in; comp. ratio 6.3:1; supercharger ratio 10.15:1; gear-driven; single-stage; fuel grade 100/130; oil viscosity 100 SU sec; dry sump; dry weight 705 lbs; frontal area 11.3 sq ft; diameter 45.5 in; length 47.52 in; carburetor Bendix-Stromberg QD9A3; magneto Bendix-Scintilla VAG9DFA; shielded ignition, starter optional, Bendix-Eclipse E-80 or Jack & Hintz 6FSL3.

NOTEWORTHY FEATURES

One-piece, barrel-type (aluminum-alloy) crankcase. Cylinders with steel barrels and integral aluminum-alloy fins. One inlet valve and one sodium-cooled exhaust valve per cylinder, actuated by push rods. Single-throw, two-piece, counterbalanced crankshaft supported in one roller and one plain bearing. Engine can be operated with crankshaft horizontal or vertical (nose-up) with minor external changes.



CONTINENTAL Model C115-2, C125-2 T. C. 236

TYPE: 6-cyl horizontal opposed; air-cooled; direct drive.

PERFORMANCE: Takeoff (C115-2) hp 125 at 2550 rpm, (C125-2) hp 135 at 2750 rpm; rated (C115-2) hp 115 at 2350 rpm, (C124-2) hp 125 at 2550 rpm.

SPECIFICATIONS: Displacement 282 cu in; bore 4.062 in; stroke 3.625 in; comp. ratio 6.3:1; dry weight 256.89 lbs; width 31.60 in; length 41 in; fuel grade 73; oil viscosity SAE 30 or 40; wet sump; carburetor Marvel MA-3SPA float type; magnetos Scintilla S6LN-21; shielded ignition; starter and generator Delco-Remy; no fuel pump, a-c optional.

NOTEWORTHY FEATURES

Installed on Globe Swift, Call Callaire, Rua Boa Vista CAP-10, Skandinavisk Aero Industri A/S K-2. Weight is without starter.

CONTINENTAL Model C90-12F, (-8F) T. C. 252

TYPE: 4-cyl horizontal opposed; air-cooled; direct drive.

PERFORMANCE: Takeoff hp 90 at 2475 rpm; cruising hp 68 at 2250.

SPECIFICATIONS: Displacement 201 cu in; bore 4.06 in; stroke 3.875 in; comp. ratio 7.0:1. Dry weight (C90-12F) 188 lbs, (C90-8F) 184 lbs; width (C90-12F) 31.60 in, (C90-8F) 31.50 in; length (C90-12F) 32 in, (C90-8F) 31 in. Fuel grade (C90-12F) 80/87, (C90-8F) 80; oil viscosity SAE 30 and 40; wet sump; carburetor, Stromberg NA-S3A1. Magnetos, Scintilla S4LN-21; starter and generator, Delco-Remy; fuel pump none.

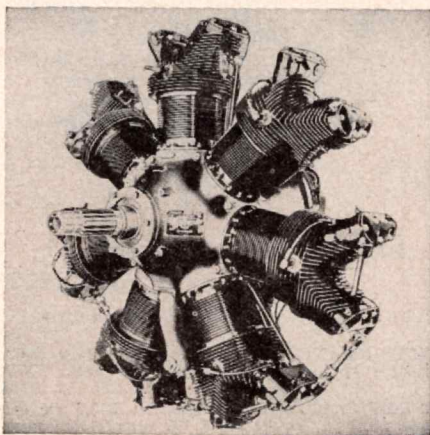
NOTEWORTHY FEATURES

Installed on Cessna Aircraft. Weight is without starter.

CONTINENTAL Model W670-23 T. C. 162

TYPE: 7-cyl radial; air-cooled; direct drive.

PERFORMANCE: Takeoff hp 240 at 2200 rpm; cruising hp 175 at 2000 (23½ in Hg).



SPECIFICATIONS: Displacement 667 cu in; bore 5.125 in; stroke 4.625 in; comp. ratio 6.3:1. Fuel grade 80 octane; oil viscosity SAE 30 & 40; lubrication dry sump; dry weight 519 lbs; diameter 45.2 in; length 35.6 in; carburetor Bendix NA-R6G float type; magnetos Scintilla MN7-DFA; shielded ignition. No starter or fuel pump supplied.

NOTEWORTHY FEATURES

Used in Cessna 190.

JACOBS Model O-240A

TYPE: 4-cyl horizontal opposed; air-cooled; direct drive.

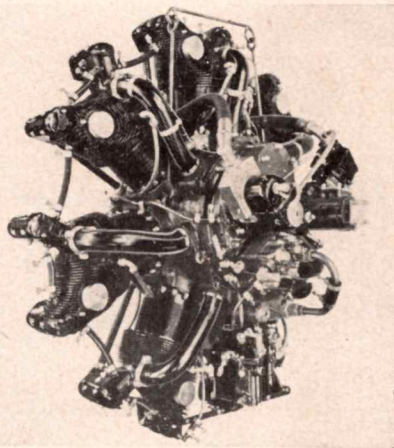
PERFORMANCE: Takeoff hp 100 at 2300 rpm; cruising hp 75 at 2090 rpm. Specific fuel consumption .48 at 60% power at SL.

SPECIFICATIONS: Displacement 241 cu in; bore 4.375 in; stroke 4.00 in; comp. ratio 6.5:1. Fuel grade 80; oil viscosity 80; wet sump. Dry weight 200 lbs; frontal area 2.5 sq ft; width 33.6 in; length 39.6 in. Carburetor: Marvel-Schebler MA-3SPA float-type. Magnetos: Eisemann Model LA-4, Delco-Remy distributor, starter, generator; shielded ignition. Rmec fuel pump.

NOTEWORTHY FEATURES

Compact design gives low over-all height of 18.1 in; fuel pressure-lubrication system is used with full-flow oil filter. Magneto-battery ignition sys-

tem with automatic advance. Fuel injection is optional. A 2-piece magnesium-alloy crankcase, split vertically, with integral wet sump, is used. Cylinders have aluminum-alloy heads with closely spaced fins shrunk onto forged alloy-steel cylinder barrels. Dual camshafts operate push rods and overhead valves—hydraulic tappets are optional. Sodium-cooled exhaust valves, one-piece balanced, forged-steel crankshaft.



JACOBS Model R-915A

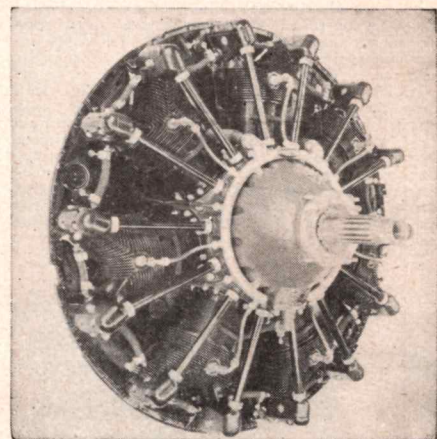
TYPE: 7-cyl radial; air-cooled; direct drive.

PERFORMANCE: Takeoff hp 375 at 2300 rpm; cruising hp 275 at 2070 rpm.

SPECIFICATIONS: Displacement 914 cu in; bore 5.50 in; stroke 5.50 in; comp. ratio 6:1. Fuel grade 80; oil viscosity 100; dry sump; dry weight 560 lbs; frontal area 11.4 sq ft; diameter 45.6 in; length 40 in. Carburetor: Stromberg NA-R7A float-type. Magnetos: Scintilla VMN7-DF5; shielded ignition; Eclipse starter and generator. PESCO or Pomec fuel pump.

NOTEWORTHY FEATURES

Similar to the R-755A, except that heavier construction is employed throughout. Ratio of weight to horsepower is 1.5 lbs/hp.



JACOBS Model R-755E T. C. 237

TYPE: 7-cyl radial; air-cooled; geared drive.

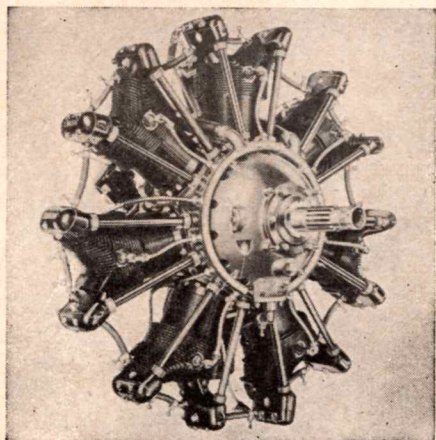
PERFORMANCE: Takeoff hp 350 at 2500 rpm; cruising hp 260 at 2250 rpm.

SPECIFICATIONS: Displacement 757 cu in; bore 5.25 in; stroke 5.00 in; comp. ratio 6.5:1. Fuel grade 91; oil viscosity 100; dry sump. Dry weight 600 lbs; frontal area 10.5 sq ft; diameter 44 in; length 42.3 in. Carburetor: Stromberg NA-R7A float-type. Magnetos: Scintilla VMN7-DF5; shielded ignition; Eclipse starter and generator. PESCO fuel pump.

NOTEWORTHY FEATURES

Reduction gear provides low propeller speed of 1623 rpm at takeoff and rated power, giving high propeller-thrust efficiency and low noise level. Engine ratings also have been increased substantially with the use of a higher crankshaft rpm. Construction is similar to R-755A except that

heavier design is employed throughout. The reduction gear is of the planetary type. Two pucker-type torsional vibration dampers are used. The master-rod bearing surface is lead and indium-coated silver. Cam ring is of the shelf-mounted type.



JACOBS Model R-755A

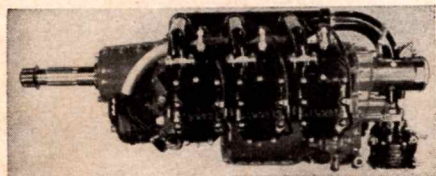
TYPE: 7-cyl radial; air-cooled; direct drive.

PERFORMANCE: Takeoff hp 300 at 2200 rpm; cruising hp 225 at 2000 rpm. Specific fuel consumption at cruising hp .45.

SPECIFICATIONS: Displacement 757 cu in; bore 5.25 in; stroke 5.00 in; comp. ratio 6:1. Fuel grade 80; oil viscosity 100; dry sump. Dry weight 505 lbs; frontal area 10.5 sq ft; diameter 44 in; length 39.5 in. Weight-to-horsepower ratio 1.68 lb/hp. Carburetor: Stromberg NA-R7A float-type. Magneto: Scintilla VMN7-DF5; shielded ignition; Eclipse starter and generator. Fuel pump PESCO or Romec.

NOTEWORTHY FEATURES

Drives are provided for starter, generator, vacuum pump, hydraulic pump, propeller governor, magneto, battery ignition distributor, fuel pump and tachometer. The cylinders have aluminum-alloy heads with closely-spaced fins shrunk onto forged alloy-steel barrels. Aluminum-bronze valve seats are shrunk into the cylinder head. Tulip-type intake and sodium-cooled exhaust valves actuated by push rods. Valve rocker arms mounted on tapered roller bearings. The 2-piece main crankcase, split along the cylinder centerlines, is equipped with integral manifold. Pistons are forged aluminum alloy with full-floating piston pins. A 1-piece alloy-steel master rod is used with aluminum-alloy connecting rods. The 2-piece counter balanced forged-steel crankshaft is mounted on roller and ball bearings. Many parts, including master rod and gears, are shot-blasted to increase fatigue resistance.



JACOBS Model 0-360A

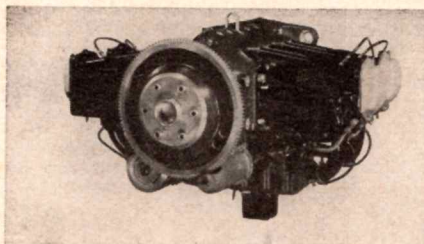
TYPE: 6-cyl horizontal opposed; air-cooled; direct drive.

PERFORMANCE: Takeoff hp 165 at 2400 rpm; cruising hp 120 at 2160 rpm. Specific fuel consumption .48 at 60% power at SL.

SPECIFICATIONS: Displacement 361 cu in; bore 4.375 in; stroke 4.00 in; comp. ratio 6.5:1. Fuel grade 80; oil viscosity 80; wet sump; dry weight 300 lbs; frontal area 2.5 sq ft; width 33.6 in; length 47.4 in. Carburetor: Marvel-Schebler MA-4.5 float-type. Magneto: Eisemann LA-6; Delco-Remy distributor, starter, generator; shielded ignition. Romec fuel pump.

NOTEWORTHY FEATURES

Similar to O-240A, except 6-cyl. construction. One-piece balanced, forged-steel crankshaft with four main bearings. Over-all height is 18.1 in.



LYCOMING Model 0-290-D

T. C. 229

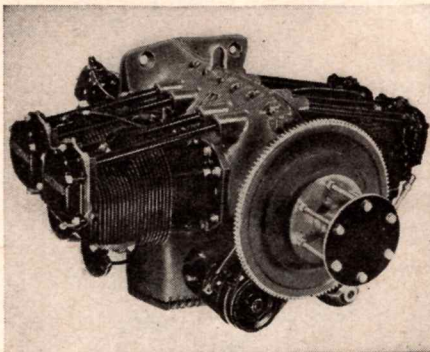
TYPE: 4-cyl opposed; air cooled; direct drive.

PERFORMANCE: Takeoff hp 130 at 2800 rpm; cruising hp 94 at 2350 rpm at sea level.

SPECIFICATIONS: Displacement 289 cu in; bore 4.875 in; stroke 3.875 in; compression ratio 6.5:1. Dry weight 258 lbs; frontal area 5.12 sq ft; width 32.32 in; length 29.56 in. Fuel grade 80; oil viscosity W-30; wet sump. Carburetor: Marvel Schebler MA-3A, float type. Magneto: Scintilla S4LN-20; ignition not shielded. Starter and generator, Delco Remy; fuel pump, a-c.

NOTEWORTHY FEATURES

Weight includes starter and generator. Generator, starter and fuel pump are automotive types. Powers the Piper PA-20 Pacer "125" and "135."



LYCOMING Model 0-235-C1

T. C. 223

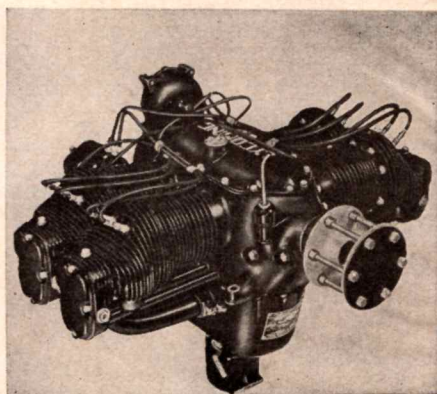
TYPE: 4-cyl opposed; air-cooled; direct drive.

PERFORMANCE: Takeoff hp 115 at 2800 rpm; cruising hp 81 at 2350 rpm; at sea level.

SPECIFICATIONS: Displacement 233.3 cu in; bore 4.375 in; stroke 3.875 in; compression ratio 6.75:1. Dry weight 235 lbs; frontal area 5.01 sq ft; width 32 in; length 29.56 in. Fuel grade 80; oil viscosity S-40 or W-30; wet sump. Carburetor: Marvel Schebler MA-3A, float type. Magneto: Scintilla S4LN-20; ignition not shielded. Starter and generator, Delco Remy; fuel pump, a-c.

NOTEWORTHY FEATURES

Weight includes starter and generator. Generator, starter and fuel pump are automotive types. Powers the Piper PA; 6 Clipper, PA-18 Super Cub and PA-20 Pacer "115," Jamieson Jupiter, and the Monocoupe 90-AL-115.



LYCOMING Model 0-145-B2

T. C. 210

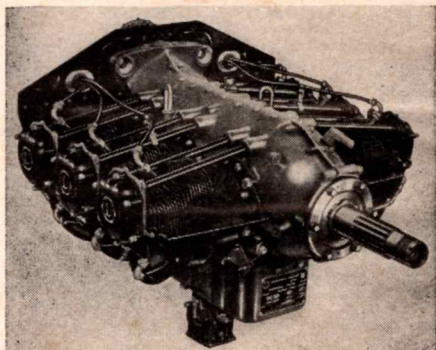
TYPE: 4-cyl opposed; air-cooled; direct drive.

PERFORMANCE: Takeoff hp 65 at 2550 rpm; cruising hp 49 at 2300 rpm at sea level.

SPECIFICATIONS: Displacement 144.49 cu in; bore 3.625 in; stroke 3.5 in; compression ratio 6.5:1. Dry weight 163.40 lbs; frontal area 4.22 sq ft; width 29.56 in; length 24.62 in. Fuel grade 73; oil viscosity S-40 or W-30; wet sump. Carburetor: Marvel-Schebler MA-2, float type. Magneto: Scintilla SF-4L; ignition not shielded.

NOTEWORTHY FEATURES

Powers the Piper PA-15 and Mooney M-18-L.



LYCOMING Model O-435-A

T. C. 228

TYPE: 6-cyl opposed; air-cooled; direct drive.

PERFORMANCE: Takeoff hp 190 at 2550 rpm; cruising hp 143 at 2300 rpm at sea level.

SPECIFICATIONS: Displacement 434 cu in; bore 4.875 in; stroke 3.875 in; compression ratio 6.5:1. Dry weight 392.5 lbs; frontal area 6.64 sq ft; width 32.24 in; length 38.10 in. Fuel grade 80; oil viscosity S-50 or W-40; wet sump. Carburetor: Marvel-Schebler MA-4.5, float type. Magneto: Scintilla SF-6L-8; shielding optional. Starter and generator, Delco Remy; fuel pump, AC.

NOTEWORTHY FEATURES

Weight includes starter and generator. Starter, generator and fuel pump are automotive types. This engine powers the Bellanca.

LYCOMING Model GSO-580 T. C. 256

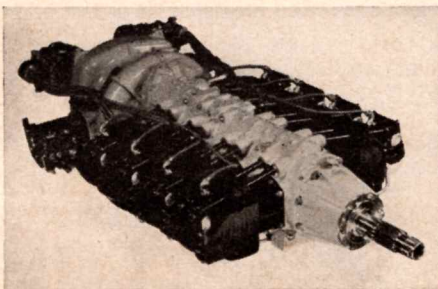
TYPE: 8-cyl opposed; air-cooled; gear drive.

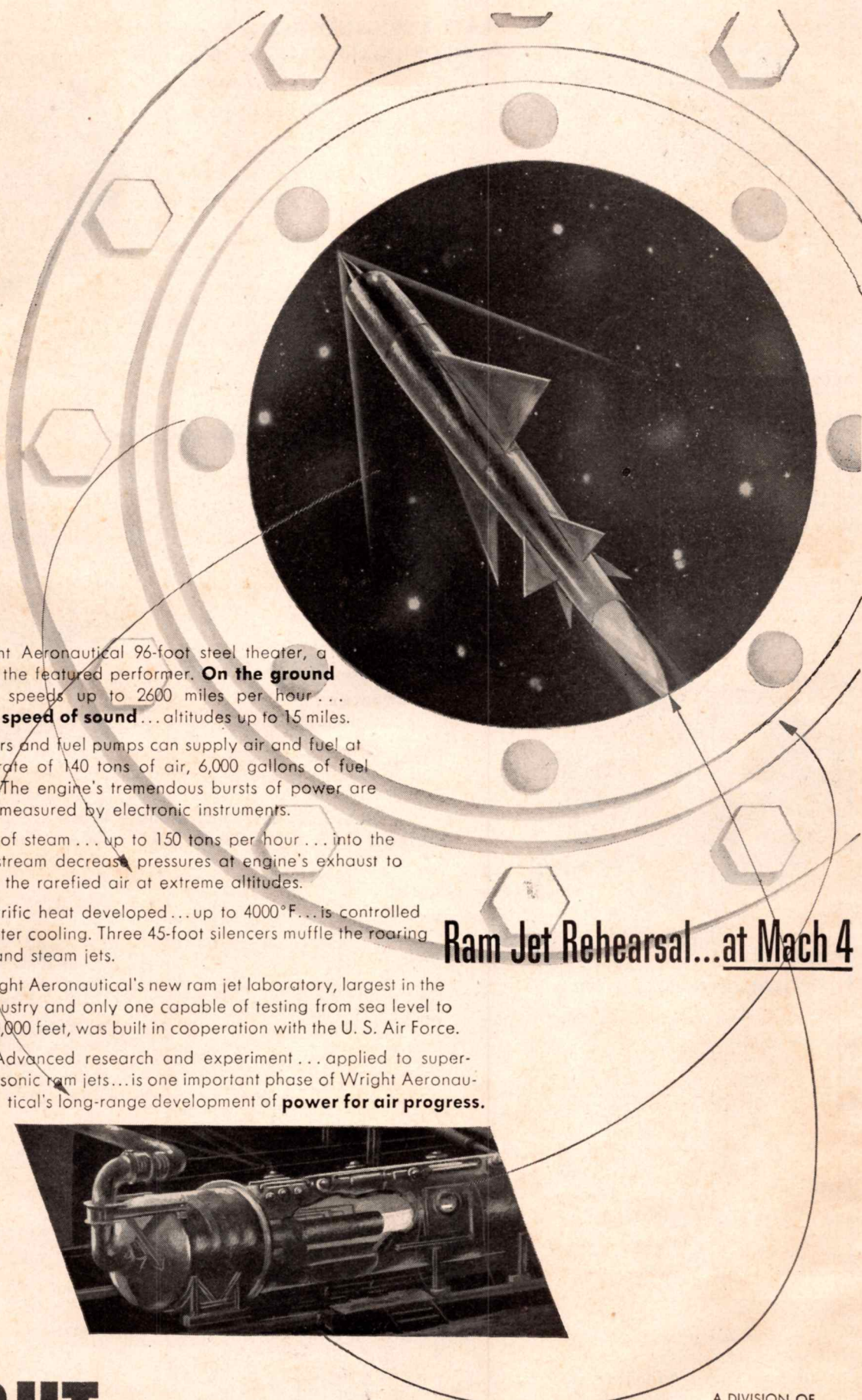
PERFORMANCE: Takeoff hp 375 at 3300 rpm; cruising hp 240 at 2730 rpm at sea level.

SPECIFICATIONS: Displacement 578 cu in; bore 4.875 in; stroke 3.875 in; compression ratio 7.3:1. Supercharger; high ratio 7.9:1; single-stage; gear drive. Dry weight 619 lbs; frontal area 4.6 sq ft; width 33.18 in; length 57.98 in. Fuel grade 91/98; oil viscosity W-40; dry sump. Carburetor: Bendix Stromberg PSH-9BHE, pressure type. Magneto: Scintilla SF8RN; shielded ignition.

NOTEWORTHY FEATURES

Over-all height of engine has been kept minimum so it can be submerged in a wing.





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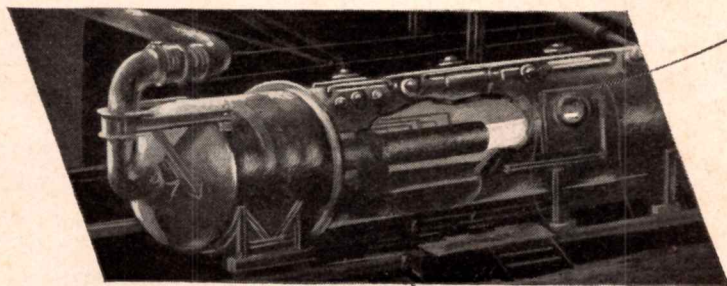
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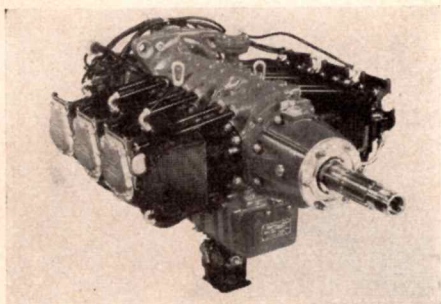


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LYCOMING Model GO-435-A2 (-C2)

T. C. 228

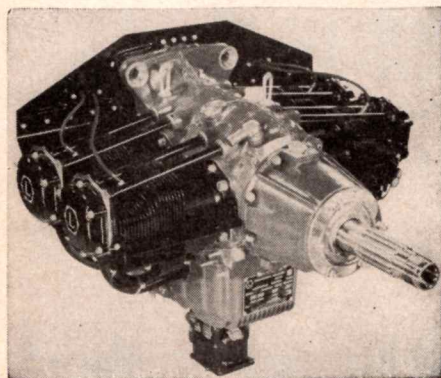
TYPE: 6-cyl opposed; air-cooled; gear drive.

PERFORMANCE: Takeoff *hp* 260 at 3400 *rpm*; cruising *hp* 180 at 2750 *rpm* at sea level.

SPECIFICATIONS: Displacement 434 *cu in*; bore 4.875 *in*; stroke 3.875 *in*; compression ratio 7.3:1. Dry weight (GO-435-A2) 465.5 *lbs*; (GO-435-C2) 432 *lbs*; frontal area 6.81 *sq ft*; width 33.12 *in*; length 47.71 *in*. Fuel grade 91/98; oil viscosity S-50 or W-40; wet sump. Carburetor: Marvel-Schebler MA-4-5, float type. Magnetos: Scintilla SF6LN-8; shielded-ignition optional. Starter and generator, Delco Remy; fuel pump, AC.

NOTEWORTHY FEATURES

Weight of GO-435-A2 includes starter and generator. Model GO-435-C2 is same as Model GO-435-A2 except it does not have starter and generator and weight is without these two items. Starter, generator and fuel pump are of the automotive type.



LYCOMING Model GO-290-A

TYPE: 4-cyl opposed; air-cooled; gear drive.

PERFORMANCE: Takeoff *hp* 170 at 3400 *rpm*; cruising *hp* 120 at 2750 *rpm* at sea level.

SPECIFICATIONS: Displacement 289 *cu in*; bore 4.875 *in*; stroke 3.875 *in*; compression ratio 7.50:1. Dry weight 376 *lbs*; frontal area 6.81 *sq ft*; width 33.18 *in*; length 32.24 *in*. Fuel grade 91/98; oil viscosity S-50 or W-40; wet sump, dry sump optional. Carburetor: Marvel-Schebler MA-4-5, float type. Magnetos: SF4LN-20; ignition not shielded, shielding optional. Starter and generator, Delco Remy; fuel pump, AC.

NOTEWORTHY FEATURES

Weight includes starter and generator. Generator, starter and fuel pump are automotive types.

Manufacturers engaged in powerplant development are listed in the Airframe & Powerplant Personnel Index, starting page 136.

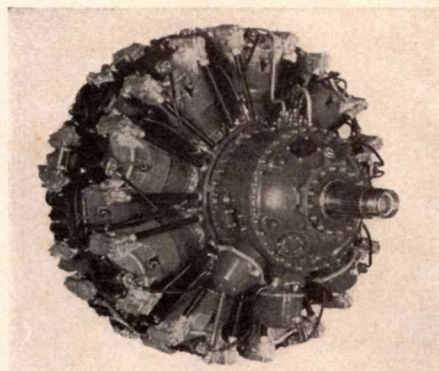
PRATT & WHITNEY Double Wasp Model CB1, CB13, CB16, (R-2800)

T. C. Pending

TYPE: 18-cyl two-bank radial; air cooled; gear drive, 0.450 or 0.4375 ratio.

PERFORMANCE: (CB1, CB13) takeoff *hp* wet 2400 at 2800 *rpm*, dry 2300 at 2800 *rpm*; (CB16) wet 2400 at 2800 *rpm*, dry 2050 at 2700 *rpm*. Specific fuel consumption .740 to .850 at 100% power.

SPECIFICATIONS: Displacement 2804 *cu in*; bore 5.75 *in*; stroke 6.00 *in*; compression ratio 6.75:1. Supercharger: single-stage; low ratio 7.29:1; high ratio (CB13) 9.1:1, (CB16) 8.4:1. Dry weight (CB1) 2357 *lbs*, (CB13, CB16) 2390 *lbs*; diameter 52.80 *in*; length 81.40 *in*. Fuel grade (CB1, CB13) 115/145, (CB16) 100/130; oil viscosity 100 at 210° *F*; dry sump. Carburetor: Stromberg PR-58E5, pressure type. Magnetos: Scintilla DLN-10; shielded ignition. Optional-make starter, generator, fuel pump.



NOTEWORTHY FEATURES

Max. cruising power shall be approved in writing after consultation with Pratt & Whitney Aircraft. (New series engine: several proposals pending.)

PRATT & WHITNEY Wasp Jr. Model B (R-985) T. C. 123

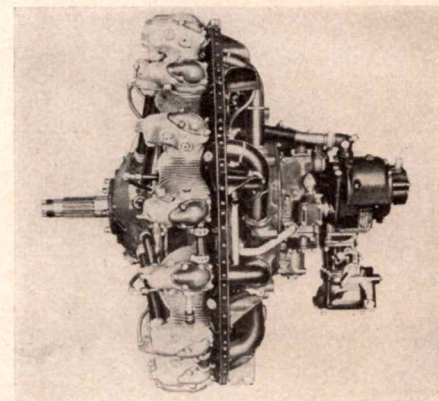
TYPE: 9-cyl radial; air-cooled; direct drive.

PERFORMANCE: Takeoff *hp* 450 at 2300 *rpm*; cruising *hp* 300 at 2000 *rpm* at 8000 *ft*. Specific fuel consumption at 100% power .670.

SPECIFICATIONS: Displacement 985 *cu in*; bore 5.1875 *in*; stroke 5.1875 *in*; compression ratio 6:1. Supercharger: single-stage; low ratio 10:1. Dry weight 683 *lbs*. Diameter 46.1 *in*; length 47.69 *in* (B-4), 42.43 *in* (B-5). Fuel grade: 80/87; oil viscosity 100 at 210° *F*; dry sump. Carburetor: Stromberg NA-R9B, float type. Magnetos: Scintilla SB9RN-3; shielded ignition. Optional-make starter, generator, fuel pump.

NOTEWORTHY FEATURES

Model B-5 installed in Beech D-18S and Spartan 12A. Model B-4 similar, but vertically installed as in Bell 42, Gyrodyne 2, Sikorsky H-5F, HO3S-1, S-51, S-51A.

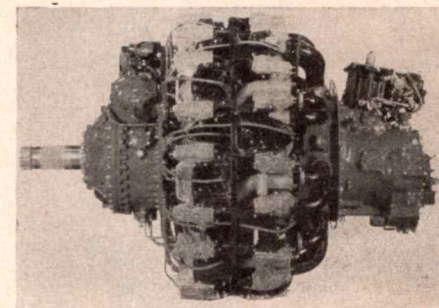


PRATT & WHITNEY Double Wasp T. C. 231 Model CA3, CA5, CA15, CA17, CA18, CA19 (R-2800)

TYPE: 18-cyl two-bank radial; air cooled; gear drive 0.450 or 0.350 ratio.

PERFORMANCE: (CA3 and CA15) takeoff *hp* wet 2400 at 2800 *rpm*, dry 2100 at 2800 *rpm*; (CA5) wet 2400 at 2800 *rpm*; (CA17) wet 2400 at 2880 *rpm* or 2000 at 2600 *rpm*, dry 2300 at 2800; (CA18) wet 2400 at 2800 *rpm* or 1900 at 2600 *rpm*; dry 2100 at 2800 *rpm*; (CA19) wet 2400 at 2800 *rpm* or 2100 at 2600 *rpm*, dry 2300 at 2800 *rpm*. Specific fuel consumption .720 to .745 at 100% power.

SPECIFICATIONS: Displacement 2804 *cu in*; bore 5.75 *in*; stroke 6.00 *in*; compression ratio 6.75:1. Supercharger: single stage; low ratio 7.29:1; high ratio (CA15 and CA17) 9.45:1, (CA18 and CA19) 9.1:1. Dry weight (CA3 and CA5) 2317 *lbs*, (CA15, 17, 18, 19) 2350 *lbs*; diameter 52.80 *in*; length 78.39 *in*. Fuel grade (CA3, 15, 18) 100/130, (CA5, 17, 19) 115/145; oil viscosity 100 at 210° *F*; dry sump. Carburetor: Stromberg PR-58E5, pressure type. Magnetos: Scintilla DLN-10; shielded ignition. Optional-make starter, generator, fuel pump.



NOTEWORTHY FEATURES

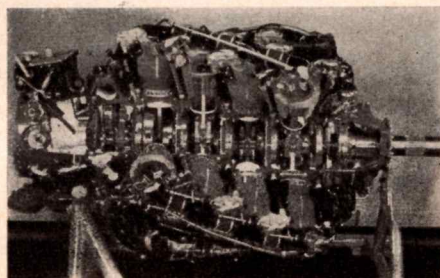
Max. cruising power shall be approved in writing after consultation with P&WA. Used on Convair 110, 240, XT-29, XT-32, Douglas DC-6A, Martin 202.

PRATT & WHITNEY Wasp Major Model TSB3-G, B13 (R-4360) T. C. 247

TYPE: 28-cyl four-bank radial; air cooled; gear drive, 0.375 or 0.425 ratio.

PERFORMANCE: Takeoff *hp* wet 3500 at 2700 *rpm*, dry 3250 to 2700 *rpm*. Specific fuel consumption .710 to .760 at 100% power.

SPECIFICATIONS: Displacement 4363 *cu in*; bore 5.75 *in*; stroke 6.00 *in*; compression ratio 6.7:1. Supercharger: single-stage; low ratio (TSB3-G) 6.375:1, (B13) 6.95:1; high ratio (B13) 6.95:1. Dry weight (TSB3-G) 3482 *lbs*, (B13) 3535 *lbs*; diameter 54.00 *in*; length (TSB3-G) 96.75 *in*; (B13) 101.75 *in*. Fuel grade



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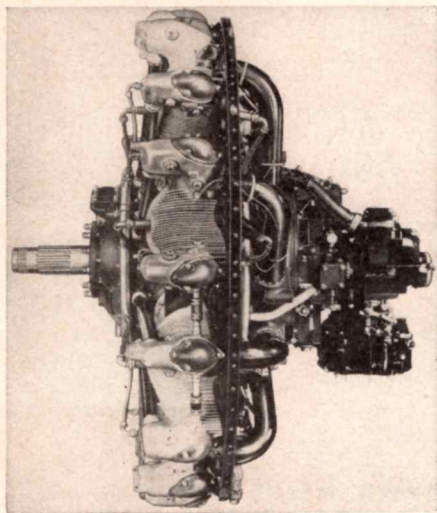


MARCH 1950

(TSB3-G) 108/135, (B13) 115/145; oil viscosity 100 at 210° F; dry sump. Carburetor: Stromberg PR-100 B3, pressure type. Magneto: Scintilla D4RN-2; shielded ignition. Optional-make starter, generator, fuel pump.

NOTEWORTHY FEATURES

Max. cruising power shall be approved in writing after consultation with Pratt & Whitney Aircraft. If fuel grade 108/135 is unavailable, 115/145 must be used. *Wasp Major* TSB3-G is used on Boeing 377 Convair B-36, Fairchild C-119 and C-120, Douglas C-74 and C-124A.



PRATT & WHITNEY Wasp Model S1H (R-1340)

T. C. 129

TYPE: 9-cyl radial; air cooled; direct or geared drive, (G) 3:2 ratio.

PERFORMANCE: Takeoff *hp* 600 at 2250 *rpm*; cruising *hp* 400 at 2000 *rpm* at 11,900 ft. Specific fuel consumption .690 at 100% power.

SPECIFICATIONS: Displacement 1344 *cu in*; bore 5.75 *in*; stroke 5.75 *in*; compression ratio 6:1. Supercharger: single-stage; low ratio 12:1. Dry weight (direct dr.) 865 *lbs*; (gear dr.) 953 *lbs*; diameter 51.80 *in*; length (direct dr. S1H1) 43.01 *in*, (gear dr. S1H1-G) 47.81 *in*. Fuel grade 80/87; oil viscosity 100 at 210° F; dry sump. Carburetor: Stromberg NA-Y9E1, float type. Magneto: Scintilla SB9R; shielded ignition. Optional-make starter, generator, fuel pump.

NOTEWORTHY FEATURES

Used on Boeing 247D and C-73, Australian *Whirraway*, Bellanca 31-50, Grumman G-73, Lockheed 10E, No. American NA-16-1 (-3), Can. *Norseman*, Douglas EJ-2 and 25-2, and Junkers JJ-52. If grade 80/87 fuel is unavailable, 91/98 or better must be used.

Model S3H (R-1340), (S3H-1 & S3H2; T. C. 143) (S3H1-G; T. C. 142)

Same as S1H1 in all respects except as follows: Cruising *hp* 400 at 2000 *rpm* at 9000 ft. Specific fuel consumption .670 at 100% power. Supercharger: low ratio 10:1. Length of motor: (S3H2) 47.70 *in*; (S3H1-G) 47.81 *in*.

NOTEWORTHY FEATURES

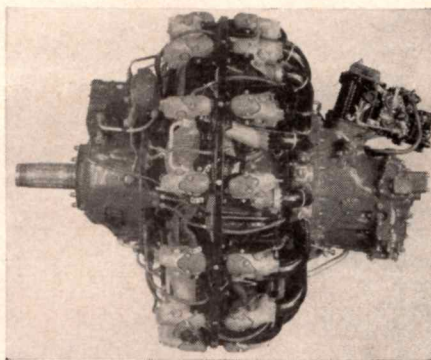
Model S3H2 is similar to S3H1 but is installed vertically as in Bell 42, Gyrodyne 2, Sikorsky H-5F, HO3S-1, S-51 and S-51A.

PRATT & WHITNEY Twin Wasp Models 2SD13-G, D14, D5, D7. (R-2000)

T. C. 129

TYPE: 14-cyl radial; air cooled; geared drive (2SD13-G and D5), 0.50 ratio; (D14 and D7), 0.5625 ratio.

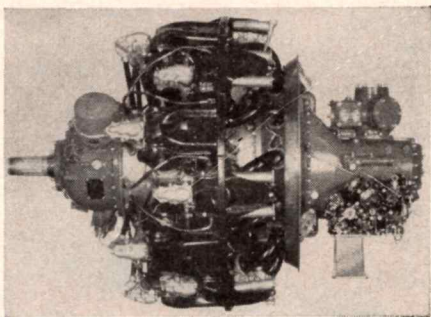
PERFORMANCE: Takeoff *hp* 1450 at 2700 *rpm*. Specific fuel consumption .690 at 100% power.



SPECIFICATIONS: Displacement 2004 *cu in*; bore 5.75 *in*; stroke 5.50 *in*; compression ratio 6.5:1. Supercharger: single-stage; low ratio 7.15:1; high ratio (2SD13-G and D14) 9.52:1. Dry weight: (2SD13-G) 1605 *lbs*; (D14) 1615 *lbs*; (D5) 1585 *lbs*; (D7) 1595 *lbs*. Diameter 49.10 *in*; length (2SD13-G and D5) 59.66 *in*; (D14 and D7) 60.50 *in*. Fuel grade 100/130; oil viscosity 100 at 210° F; dry sump. Carburetor: Stromberg PD-12F13, pressure type. Magneto: Scintilla SF-14CN-8; shielded ignition. Optional-make starter, generator, fuel pump.

NOTEWORTHY FEATURES

Max. cruising power shall be approved in writing after consultation with P & W. (*Twin Wasp* D14 and D7 are similar to 2SD13-G and D5 except for reduction-gear ratio and incorporation of torque-meter. *Twin Wasp* is used on Douglas DC-4, C-44, C-47, C-53, SAAB-90A1.)



PRATT & WHITNEY Twin Wasp Model E1 (R-2180)

T. C. 257

TYPE: 14-cyl radial; air cooled; geared drive, 0.4375 or 0.5625 ratio.

PERFORMANCE: Takeoff *hp* (wet) 1800 at 2800 *rpm*, (dry) 1650 at 2800 *rpm*; specific fuel consumption .709 at 100% power.

SPECIFICATIONS: Displacement 2180 *cu in*; bore 5.75 *in*; stroke 6.00 *in*; compression ratio 6.71:1. Supercharger: single-stage; low ratio 7:1. Dry weight 1870 *lbs*. Diameter 54.00 *in*; length 75.80 *in*. Fuel grade 100/130; oil viscosity 100 at 210° F; dry sump. Carburetor: Stromberg AR-48C1, pressure type. Magneto: Scintilla S14LN-15; shielded ignition. Optional-make starter, generator, fuel pump.

NOTEWORTHY FEATURES

Max. cruising power shall be approved in writing after consultation with P & W. Used on SAAB 90A42 and SAAB 90B2.

PRATT & WHITNEY Twin Wasp Model S1C3-G

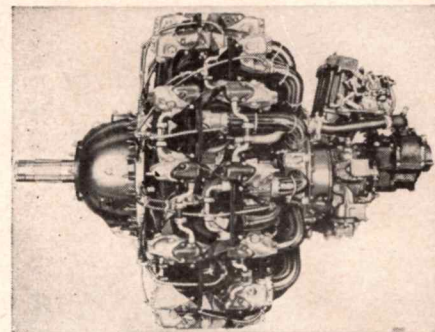
T. C. 186

TYPE: 14-cyl twin-bank radial; air cooled; geared drive .5625.

PERFORMANCE: Takeoff *hp* 1200 at 2700 *rpm*; cruising *hp* 700 at 2250 *rpm* at 12,500 ft. Specific fuel consumption .720 at 100% power.

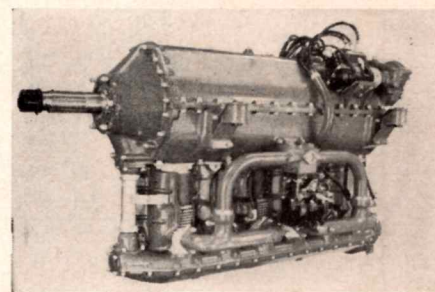
SPECIFICATIONS: Displacement 1830 *cu in*; bore 5.50 *in*; stroke 5.50 *in*; compression ratio

6.7:1. Supercharger: single-stage; low ratio 7.15:1. Dry weight 1467 *lbs*; diameter 48.19 *in*; length 61.16 *in*. Fuel grade 91/98; oil viscosity 100 at 210° F; dry sump. Carburetor: Stromberg DD-12H4, pressure type. Magneto: Scintilla SF-14LN-3; shielded ignition. Optional-make starter, generator, fuel pump.



NOTEWORTHY FEATURES

Used on Douglas DC-3, C-48B and -C, Lockheed 18.08, 18.10, C56D, C57A, C57B, and C66 and Sikorsky VS44A.



RANGER

Model 6-44OC-2 T. C. 216

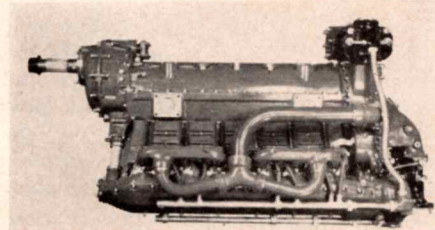
TYPE: 6-cyl inline inverted; air-cooled; direct drive.

PERFORMANCE: Takeoff *hp* 175 at 2450 *rpm*; cruising *hp* 131 at 2230 *rpm* at sea level.

SPECIFICATIONS: Displacement 441 *cu in*; bore 4½ *in*; stroke 5½ *in*; compression ratio 6.0:1; dry weight 382 *lbs*; width 21.59 *in*; length 53.16 *in*; height 33.50 *in*; fuel grade 65; oil viscosity SAE 60; sump, full pressure type; carburetor Stromberg NA-R4B; magnetos, Scintilla SB6RN-8 and SB6RN-10; ignition not shielded; starter, Eclipse; generator Eclipse or Esco; fuel pump, Rmec or Pesco.

MODEL 6-44OC-5

This model is the same as Model 6-44OC-2 except compression ratio is increased to 7:1 from 6:1. This gives 200 *hp* at 2450 *rpm* for takeoff and 150 *hp* at 2230 for cruising at S.L. Fuel grade 87 is used in the 6-44OC-5. It is used in the Grumman *Widgeon* and the Fairchild F-24.



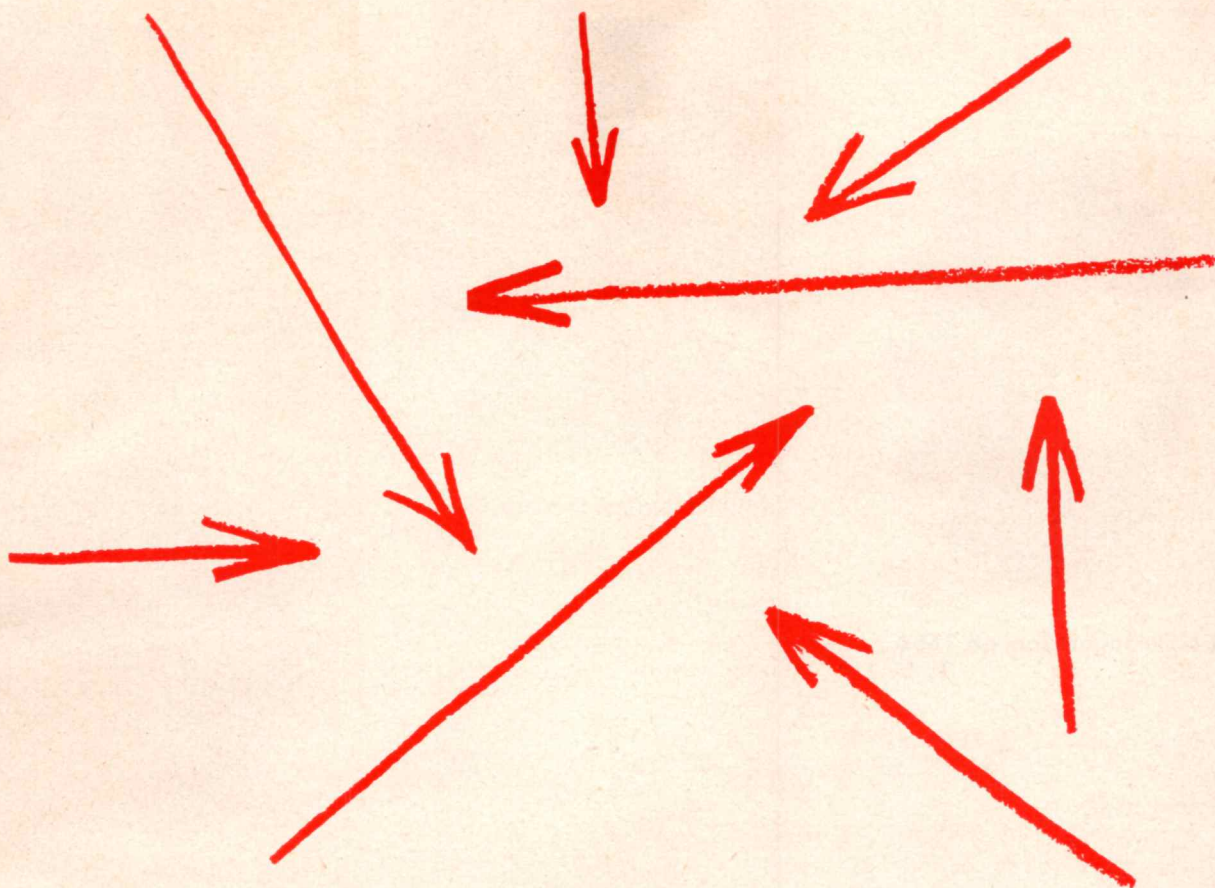
RANGER

Model SGV-77OC-1B T. C. 232

TYPE: 12-cyl inline inverted Vee; air-cooled; gear drive.

PERFORMANCE: Takeoff *hp* 520 at 3150 *rpm*; cruising *hp* 338 at 2725 *rpm* at 15,000 ft.

SPECIFICATIONS: Displacement 773 *cu in*; bore 4 *in*; stroke 5½ *in*; comp. ratio 6.5:1; supercharger, low ratio 9.5:1; gear driven, single stage;



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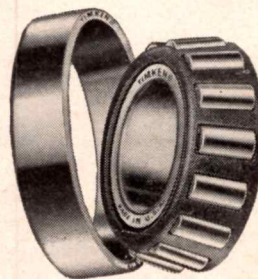
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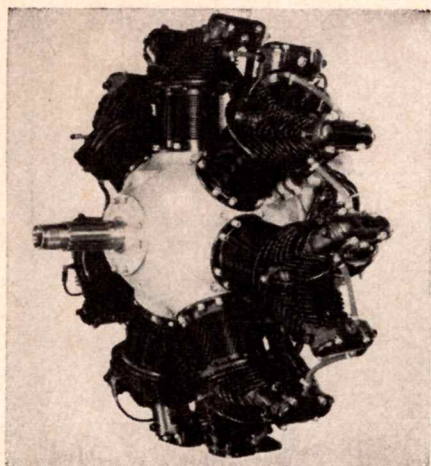
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TAPERED ROLLER BEARINGS



dry weight 759 lbs; width 32.44 in; length 66.45 in; height 34.13 in; fuel grade 91; oil viscosity, grade 1120; sump full-pressure type; carburetor Stromberg QD-9B1; Magnetos Scintilla DFLN-6, shielded ignition; starter and generator, Eclipse; fuel pump Pesco.

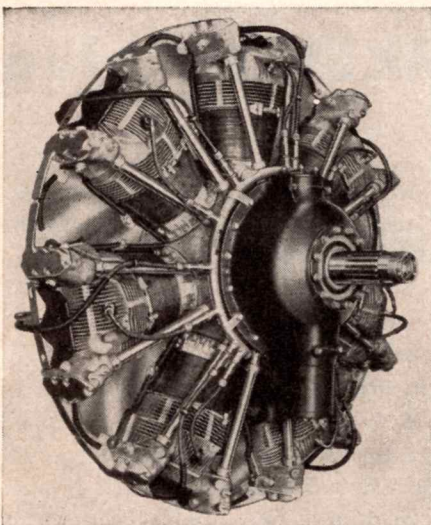


WARNER Super Scarab 165A T. C. 214

TYPE: 7-cyl radial; direct drive.

PERFORMANCE: Takeoff hp 175 at 2250 rpm; cruising hp 124 at 1910 rpm at SL. Fuel consumption at 75% power 11 gph at SL.

SPECIFICATIONS: Displacement 500 cu in; bore 4.625 in; stroke 4.250 in; compression ratio 6.4:1. Fuel grade 73; oil viscosity 120 at 210° F; dry sump. Dry weight 341 lbs; frontal area 7.6 sq ft; diameter 37 in; length 30.5 in. Carburetor: Holley 419. Magnetos: Scintilla AMN-7DF; shielded ignition optional; Eclipse starter, generator. Titan fuel pump, Pesco vacuum pump.



WRIGHT Cyclone 7BA (R-1300-1)

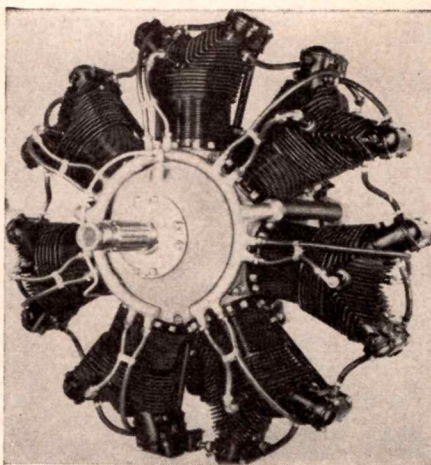
TYPE: 7-cyl radial; geared drive.

PERFORMANCE: Takeoff hp 800 at 2600 rpm; cruising hp 490 at 2200 rpm at 11,800 ft. Specific fuel consumption at 60% power .46 at 13,000 ft.

SPECIFICATIONS: Displacement 1300 cu in; bore 6.125 in; stroke 6.132 in; compression ratio 6.2:1. Supercharger: gear-driven, single stage; low ratio 7.2:1. Fuel grade 91/98; oil viscosity 120, dry sump. Dry weight 1045 lbs; frontal area 13.8 sq ft; diameter 50.5 in; length 48.1 in. Carburetor: Stromberg PD9F-1 pressure-type. Magnetos: Bosch S7LU-2; shielded ignition. Starter, generator, fuel-pump makes optional.

NOTEWORTHY FEATURES

Installed in North American T-28 trainer; scheduled for installation in new Goodyear experimental blimp.

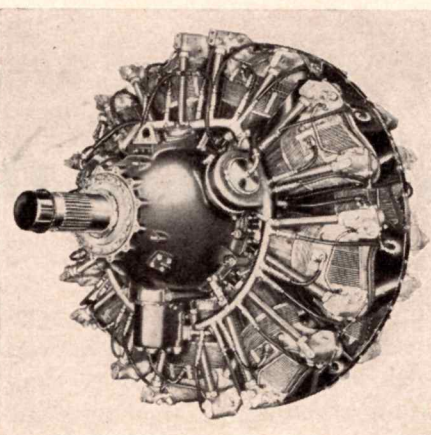


WARNER Super Scarab-185 T. C. 235

TYPE: 7-cyl radial; direct-drive.

PERFORMANCE: Takeoff hp 200 at 2475 rpm; cruising hp 139 at 1978 rpm at SL. Fuel consumption at 75% power 12.4 gph at SL.

SPECIFICATIONS: Displacement 550 cu in; bore 4.875 in; stroke 4.250 in. Compression ratio 6.2:1. Fuel grade 73; oil viscosity 120 at 210° F; dry sump. Dry weight 344 lbs; frontal area 7.6 sq ft; diameter 37 in; length 30.5 in. Carburetor: Holley 419. Magnetos: Scintilla AMN-7DF, shielded ignition optional; Eclipse starter, generator. Titan fuel pump; Pesco vacuum pump.



WRIGHT Cyclone 18CA (R-3350-26W)

TYPE: 18-cyl radial; geared drive.

PERFORMANCE: Takeoff hp 2700 at 2900 rpm; other data restricted.

SPECIFICATIONS: Displacement 3350 cu in; bore 6.125 in; stroke 6.312 in; compression ratio 6.5:1. Supercharger: gear-driven, single-stage; low ratio 6.5:1, high ratio 8.7:1. Fuel grade 115/145; oil viscosity 120, dry sump. Dry weight 2848 lbs; frontal area 16.9 sq ft; diameter 55.6 in; length 81.9 in. Carburetor: Bendix PR-58U1, impeller-injection type. Magnetos: Bosch DF18LU-3; shielded ignition. Accessory makes optional.

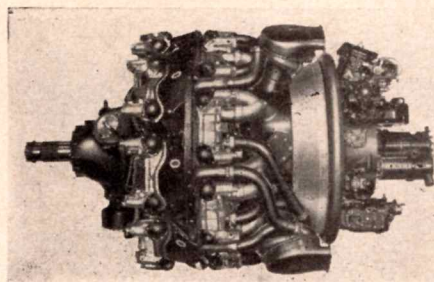
NOTEWORTHY FEATURES

Installed in Douglas AD-3 Skyraider, Lockheed P2V-3 Neptune, Martin XP5M-1.

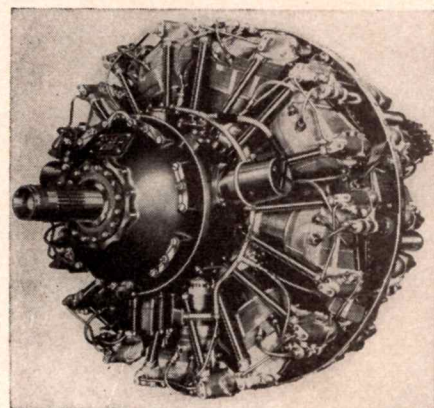
WRIGHT Turbo-Cyclone 18 (R-3350-30W)

TYPE: 18-cyl radial, 3 exhaust-driven turbines; geared drive.

PERFORMANCE: Takeoff hp 3250 at 2900 rpm; other data restricted.



SPECIFICATIONS: Displacement 3350 cu in; bore 6.125 in; stroke 6.312 in; compression ratio 6.5:1. Supercharger: gear-driven, single-stage; low ratio 6.5:1, high ratio 8.7:1. Dry sump, shielded ignition. Other data restricted.



WRIGHT Cyclone 18BD (R-3350-24W) T. C. 218

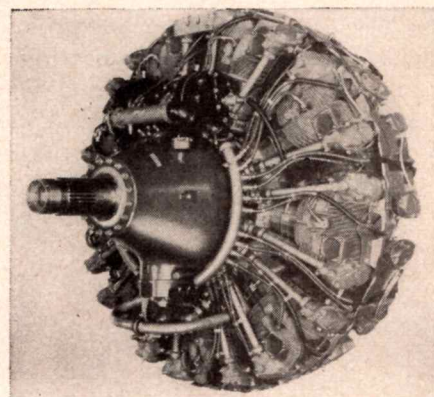
TYPE: 18-cyl radial; geared drive.

PERFORMANCE: Takeoff hp 2500 at 2800 rpm; cruising hp 1470 at 2400 rpm at 14,700 ft. Specific fuel consumption at 60% power .45 at 8000 ft.

SPECIFICATIONS: Displacement 3350 cu in; bore 6.125 in; stroke 6.312 in; compression ratio 6.5:1. Supercharger: gear-driven, single-stage; low ratio 6.5:1, high ratio 8.7:1. Fuel grade 100/130; oil viscosity 120, dry sump. Dry weight 2884 lbs; frontal area 16.9 sq ft; diameter 55.6 in; length 78.5 in. Carburetor: Bendix 135091 injection type. Magnetos: Scintilla DLN-9, shielded ignition. Accessory makes optional.

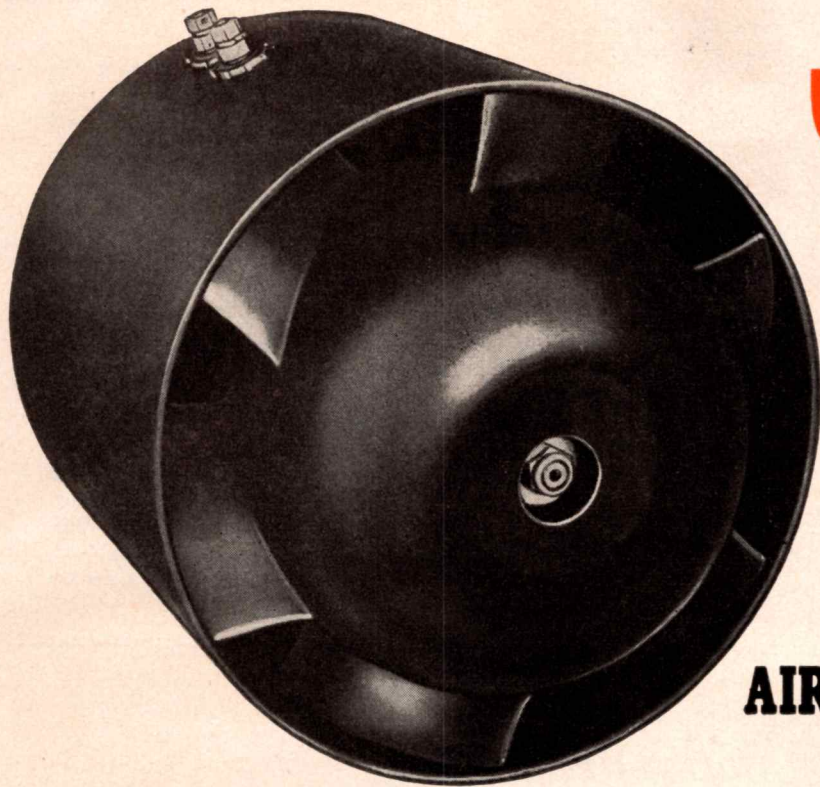
NOTEWORTHY FEATURES

Installed in Lockheed L-649 and L-749 Constellations and P2V-1 Neptune, Douglas AD-1 Skyraider.



WRIGHT Cyclone 18BA (R-3350) T. C. 218

TYPE: 18-cyl radial; geared drive.



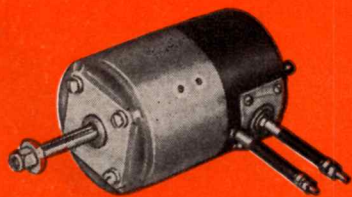
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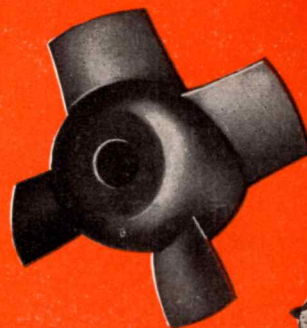
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PERFORMANCE: Takeoff *hp* 2200 at 2800 *rpm*; cruising *hp* 1400 at 2300 *rpm* at 12,100 *ft.* Specific fuel consumption at 60% power .44 at 10,000 *ft.*

SPECIFICATIONS: Displacement 3350 *cu in.*; bore 6.125 *in.*; stroke 6.315 *in.*; compression ratio 6.5:1. Supercharger: gear-driven, single-stage; low ratio 6.5:1, high ratio 8.7:1. Fuel grade 100/130; oil viscosity 120, dry sump. Dry weight 2780 *lbs.*; frontal area 17 *sq ft.*; diameter 55.8 *in.*; length 76.2 *in.* Carburetor: Bendix 135091, injector type. Magnetos: Scintilla DF18LN-1; shielded ignition. Accessory makes optional.

NOTEWORTHY FEATURES

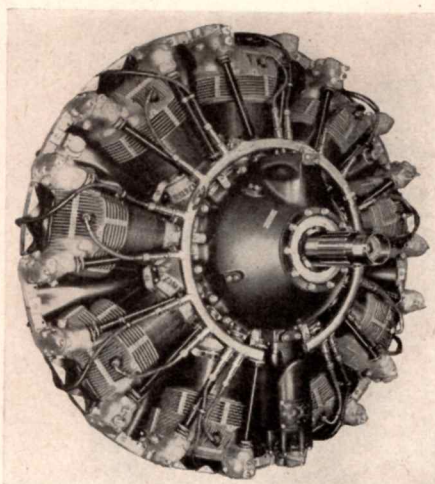
Installed in Boeing B-29 *Superfortress* and Lockheed L-49 *Constellation*.

WRIGHT Cyclone 9HE (R-1820) T. C. 243

TYPE: 9-cyl radial; geared drive.

PERFORMANCE: Takeoff *hp* 1525 at 2800 *rpm*; cruising *hp* 890 at 2400 *rpm* at 11,000 *ft.* Specific fuel consumption at 60% power .45 at 15,000 *ft.*

SPECIFICATIONS: Displacement 1820 *cu in.*; bore 6.125 *in.*; stroke 6.875 *in.*; compression ratio 6.8:1. Supercharger: gear-driven, single-stage; low ratio 7.2:1, high ratio 8.7:1. Fuel grade 100/130; oil viscosity 120, dry sump. Dry weight 1421 *lbs.*; frontal area 16.4 *sq ft.*; diameter 54.9



in.; length 49.1 *in.* Carburetor: Stromberg PD12K-14, pressure-type. Magnetos: Scintilla SF9LN-4; shielded ignition. Accessory makes optional.

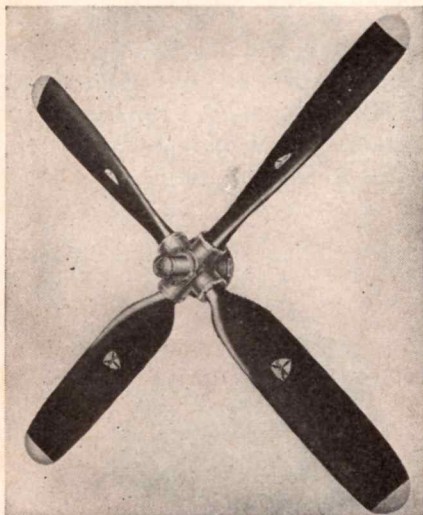
NOTEWORTHY FEATURES

Installed in Douglas *Super DC-3*. Cyclone Model 9HD develops 1425 *hp* at 2700 *rpm*, with .44 specific fuel consumption at 11,000 *ft.*; other data similar.

"By the end of the year the CAA estimated that it was 59% along the way toward complete revision of the Federal Airways from low to very-high frequency radio aids. Of the approximately 400 VHF ranges which will blanket the country, 370 are in, and most of those are either in operation or ready to be turned on. At 89 points, 87 in Continental U. S. and two in Alaska, Instrument Landing Systems are in daily use. At most of the communications stations and traffic control centers, CAA communications are conducted on VHF radio, which is static-free."

—CAA Bulletin No. CAA-399

1950 Annual Directory of AIRCRAFT PROPELLERS



AEROPRODUCTS Aeroprop Model A542F-D1

PERFORMANCE: Maximum *hp* (except takeoff) 1240; maximum *rpm* (except takeoff) 1145.

SPECIFICATIONS: No. of blades 4; diameter 11 *ft.*; weight 538 *lbs.* Steel blades; blade pitch variable; feathering; activity factor 133; pitch change automatic, hydraulic; engine shaft SAE 50 spline.

NOTEWORTHY FEATURES

Self-contained unit incorporating selective constant speed. All parts, including hydraulic pump and governor are contained within the propeller. Blades incorporating a longitudinal strengthening rib, are composed of a forged-steel camber sheet, copper-brazed into one light strong assembly. Installed on N. A. F-82 aircraft. Model A-542 without instant feathering feature installed on F-51.

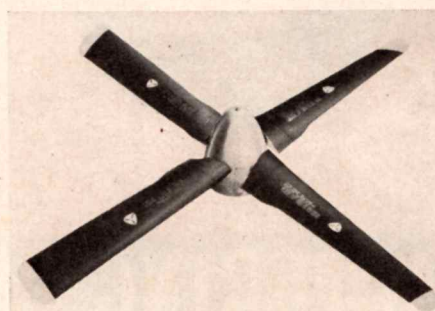


AEROPRODUCTS Aeroprop Model A422-E1

PERFORMANCE: Maximum *hp* (except takeoff) 600; maximum *rpm* (except takeoff) 1350.

SPECIFICATIONS: No. of blades 2; diameter 10 *ft* 6 *in.*; weight 237 *lbs.* Steel blades; blade pitch variable; activity factor 148; automatic, hydraulic pitch change; engine shaft SAE 40 spline.

Completely self-contained unit, incorporating simplicity in design, ease of installation and maintenance. Used by North American T-28.



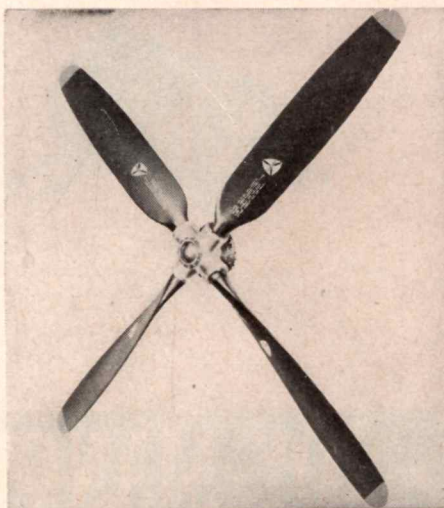
AEROPRODUCTS Aeroprop Model A644FN-A1

PERFORMANCE: Maximum *hp* (except takeoff) 2500; maximum *rpm* (except takeoff) 1083.

SPECIFICATIONS: No. of blades 4; diameter 15 *ft.*; weight 858 *lbs.*; blade pitch variable, feathering, reversible; activity factor 123; pitch change hydraulic, automatic; engine shaft SAE 60 spline.

NOTEWORTHY FEATURES

Self-contained unit incorporating instant feathering, selective constant-speed and reversing. All parts, including hydraulic pump and governor, are within the propeller; blades are hollow steel. A flattened seamless tapered tube serves as the main structural member to which is silver-brazed the airfoil contour that is die-formed from one piece of sheet steel, roll-welded at the trailing edge. The blade cavity is filled with light, cellular material that is bonded to the steel to stabilize secondary vibratory stresses. Blades of this design are engineered for engines up to 10,000 *hp*.



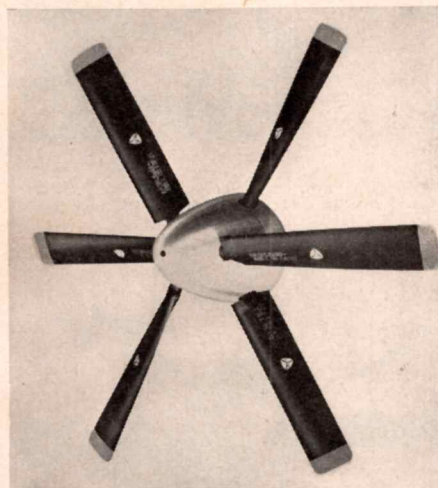
AEROPRODUCTS Aeroprop Model A642-G8

PERFORMANCE: Maximum *hp* (except takeoff) 2100; maximum *rpm* (except takeoff) 1138.

SPECIFICATIONS: No. of blades 4; diameter 13 ft 6 in; weight 539 lbs. Blade pitch variable; activity factor 112; pitch change hydraulic, automatic.

NOTEWORTHY FEATURES

Engine ratings are maximum for current engines; however, propeller is designed to handle expected rating increases adequately. Currently used on USN AD series. Same features as Model A-542.



AEROPRODUCTS

Aeroprop

Model AD8664FN

PERFORMANCE: Maximum *hp* (except takeoff) 5200; maximum *rpm* (except takeoff) 916.

SPECIFICATIONS: No. of blades 6; diameter 15 ft; weight 1325 lbs. Blade pitch variable, feathering, reversible; activity factor 132; pitch change hydraulic, automatic; engine shaft SAE 60 or 80 spline.

NOTEWORTHY FEATURES

A contra-rotating turbo propeller incorporating a self-contained hydraulic system. For use with turbine engines from 5000 to 10,000 *hp* turbine speeds up to 15,000 *rpm*. Used with Allison T-40 turbines on Navy XP5Y, XA2D, and XA2J airplanes.



AEROPRODUCTS

Aeroprop

Model A322F-A1

PERFORMANCE: Max. *hp* (except takeoff) 450; max. *rpm* (except takeoff) 2300.

SPECIFICATIONS: No. of blades 2; diameter 8 ft 3 in; weight 207 lbs. Blade pitch variable, feathering; activity factor 120; pitch change hydraulic, automatic.

NOTEWORTHY FEATURES

Self-contained unit incorporating instant feathering and selective constant-speed. All parts, including the hydraulic pump and governor, are within the propeller. Blades are of hollow steel, with a longitudinal strengthening rib. Instant feathering is achieved by a hub-mounted accumulator. Engine ratings listed are current maximum; propeller designed for expected rating increases; currently used on C-45 transports.

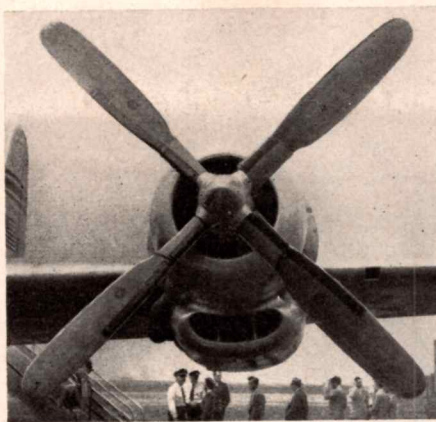
CURTISS ELECTRIC

Model C6428-B (836 Blades)

T. C. 848

PERFORMANCE: Approx. *hp* 2100; max. *rpm* 1575.

SPECIFICATIONS: No. of blades 4; diameter 14 ft 8 in; weight 539 lbs. Hollow steel blades; blade pitch variable, feathering and reversing; pitch change electric; pitch range 120°; engine shaft SAE 60 spline.



NOTEWORTHY FEATURES

Used on Martin PBM-5 and PBM-5A *Mariner* with individual governor, constant-speed and auxiliary selective-pitch controls; Provisions for reverse-pitch operation on the PBM-5A. Supplied with automatic multi-engine synchronizer control. Provisions for blade electric heating de-icing elements.

CURTISS ELECTRIC

Model C532S-E (836 Blades)

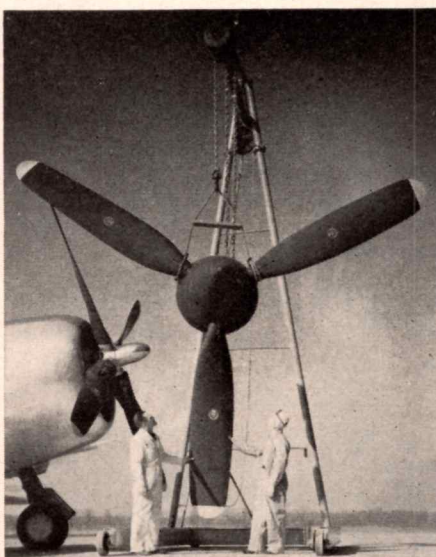
T. C. No. 735

PERFORMANCE: Approx. *hp* 1425; max. *rpm* 1520.

SPECIFICATIONS: No. of blades 3; diam. 12 ft 6 in; weight 409 lbs; hollow steel blade; blade pitch variable, feathering and reversing; pitch change electric; pitch range 120°; engine shaft SAE 50 spline.

NOTEWORTHY FEATURES

It includes automatic constant-speed and auxiliary selective-pitch controls. As installed on the Chase *Avitruic* YC-122B and C, the blades are electrically de-iced.



CURTISS ELECTRIC

Model C636SP-A (1129 Blades)

PERFORMANCE: Approx. *hp* 3500; max. *rpm* 1000.

SPECIFICATIONS: No. of blades 3; diam. 19 ft; weight 1131 lbs; hollow steel blade; blade pitch variable, feathering and reversing; pitch change electro-mechanical; pitch range 120°; engine shaft SAE 60 spline.

NOTEWORTHY FEATURES

Largest propeller in service in the world; currently used on Consolidated Vultee B-36 Super-

Bombers. Its self-contained mechanism provides reversing in one second and feathering in less than two. The blades are de-iced by internal flow of heated air. Through automatic adjustment of blade angles, the six engine-propeller speeds of the B-36 are correctly synchronized at all times and can be changed simultaneously by single-lever control. Auxiliary selective-pitch control is also provided. Constant-speed control is provided in both forward- and reverse-pitch operation. In flight, reverse thrust is optional to provide rapid rate of descent.

CURTISS ELECTRIC

Model C736SP-A (1129 Blades)

T. C. No. Military

PERFORMANCE: Approx. *hp* 3800; max. *rpm* 1000.

SPECIFICATIONS: No. of blades 3; diam. 19 ft; weight 1205 lbs; engine shaft SAE 70 spline. Other features are the same as Model C636SP-A (above).

NOTEWORTHY FEATURES

Larger engine-shaft size (SAE 70 spline) permits operation on higher-powered engines with this shaft size.

CURTISS ELECTRIC

Model C634S-C (830 Blades)

T. C. No. 825

PERFORMANCE: Approx. *hp* 3500; max. *rpm* 1260.

SPECIFICATIONS: No. of blades 3; diam. 15 ft; weight 639 lbs; hollow steel blade; blade pitch variable, feathering and reversing; pitch change electric; pitch range 120°; engine shaft SAE 60 spline.

NOTEWORTHY FEATURES

It includes automatically synchronized constant-speed and auxiliary selective-pitch controls. As installed on the 749 and 749A *Constellations*, the blades are fluid de-iced. Provision for electrical de-icing is included.

CURTISS ELECTRIC

Model C634S-C (1050 Blades)

T. C. No. Military

PERFORMANCE: Approx. *hp* 800; max. *rpm* 880.

SPECIFICATIONS: No. of blades 3; diam. 13 ft 1 in; weight 504 lbs; hollow steel blades; blade pitch variable, feathering and reversing; pitch change electric; pitch range 120°; engine shaft SAE 60 spline.

NOTEWORTHY FEATURES

Special lightweight model made for use on Good-year ZPN airships. It includes hollow steel blades, all-weather feathering, reversing and hovering, plus manual selective-pitch control, as installed.

CURTISS ELECTRIC

Model C634S-C (1052 Blades)

T. C. No. Military

PERFORMANCE: Approx. *hp* 3500; max. *rpm* 1225.

SPECIFICATIONS: No. of blades 3; diam. 16 ft 6 in; weight 687 lbs; hollow steel blades; blade pitch variable, feathering and reversing; pitch change electric; pitch range 120°; engine shaft SAE 60 spline.

NOTEWORTHY FEATURES

It includes automatically synchronized constant-speed and auxiliary selective-pitch controls. As installed on the Douglas C-124A, blades are electrically de-iced.

CURTISS ELECTRIC

Model C532S-E

(SPA-9 G. F. E. Blades)

T. C. No. Military

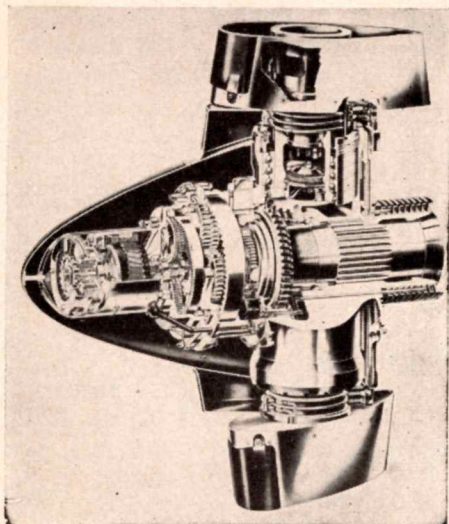
PERFORMANCE: Approx. *hp* 2400; max. *rpm* 1260.

SPECIFICATIONS: No. of blades 3; diam. 12 ft 1 in; weight 392 lbs; hollow steel blades (G.

F. E.); blade pitch variable, feathering and reversing; pitch change electric; pitch range 120°; engine shaft SAE 50.

NOTEWORTHY FEATURES

It includes automatically synchronized constant-speed and auxiliary selective-pitch controls. As installed on the Northrop *Pioneer C-125*, the blades are de-iced electrically.



CURTISS ELECTRIC

**Model C644S-B
(830-20C4 Blades)
T. C. No. Pending**

PERFORMANCE: Approx. *hp* 3500; max. *rpm* 1150.

SPECIFICATIONS: No. of blades 4; diam. 15 ft 2 in; weight 819 lbs; hollow steel blades; blade pitch variable, feathering and reversing; pitch change electric; pitch range 120°; engine shaft SAE 60 spline.

NOTEWORTHY FEATURES

It includes automatically synchronized constant-speed and auxiliary selective-pitch controls. As installed on the French SE-2010 4-engine transport, the blades are de-iced electrically. It is also used on the Martin P5M-1 and JRM-1.

CURTISS ELECTRIC

**Model C644S-B (830-2C4 Blades)
T. C. No. 826**

PERFORMANCE: Approx. *hp* 3000; max. *rpm* 1150.

SPECIFICATIONS: No. of blades 4; diam. 15 ft 2 in; weight 702 lbs; hollow steel blades; blade pitch variable, feathering and reversing; pitch change electric; pitch range 120°; engine shaft SAE 60 spline.

NOTEWORTHY FEATURES

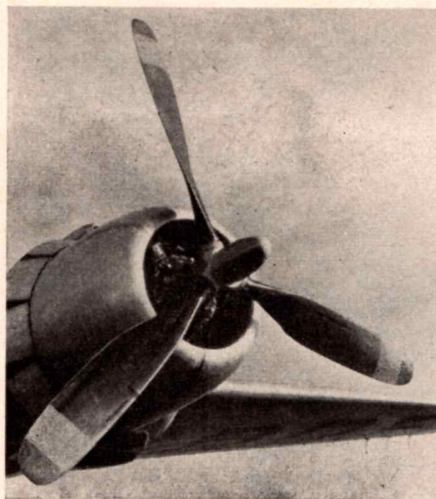
As used on the Republic XR-12 it has automatic multi-engine synchronizer control. Blade de-icing is electrical. The 14 ft 8 in diameter version, on the Martin AM-1 Mauler, utilizes individual governor constant-speed and auxiliary selective-pitch controls.

CURTISS ELECTRIC

**Model C632S-B
(740 and 744 Blades)
T. C. No. 847**

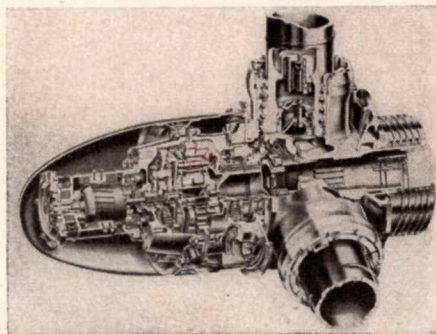
PERFORMANCE: Approx. 2400 *hp*; max. *rpm* 1260.

SPECIFICATIONS: No. of blades 3; diam. 13 ft 1 in; weight with model 740 blades 476 lbs; weight with model 744 blades 423 lbs; hollow steel blades; blade pitch variable, feathering and reversing; pitch change electric; pitch range 120°; engine shaft SAE 60 spline.



NOTEWORTHY FEATURES

This propeller with model 740 blades, used on the Consolidated *Convair Liner CV-240*, also includes automatically synchronized constant-speed and auxiliary selective-pitch controls. On the *Convair*, blades are de-iced electrically. This propeller, weighing 423 lbs with model 744 blades, is used on the Douglas DC-6 and includes all of the other features mentioned above—the only difference is blade model and weight.



CURTISS ELECTRIC

**Model C632S-B (850 Blades)
T. C. No. 847**

PERFORMANCE: Approx. *hp* 2500; max. *rpm* 1225.

SPECIFICATIONS: No. of blades 3; diam. 15 ft 1 in; weight 429 lbs; hollow steel blades; blade pitch variable, feathering, reversing; pitch change electric; pitch range 120°; engine shaft SAE 60 spline.

NOTEWORTHY FEATURES

This propeller is similar to models C632S-B listed above using the same hub as illustrated but a different blade model (850). As used on the Lockheed Model 649 and *Constellation 749*, it includes automatically synchronized constant-speed and auxiliary selective-pitch controls with fluid de-icing means. Provisions are included for de-icing blades electrically.

CURTISS ELECTRIC

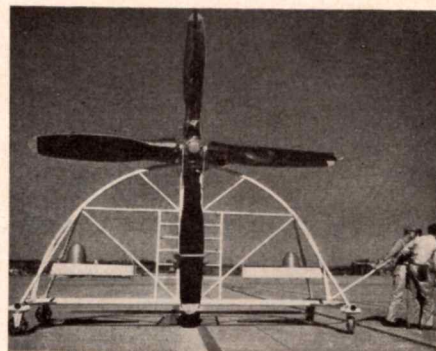
**Model C644S-B (1052 Blades)
T. C. No. 826**

PERFORMANCE: Approx. *hp* 3500; max. *rpm* 1015.

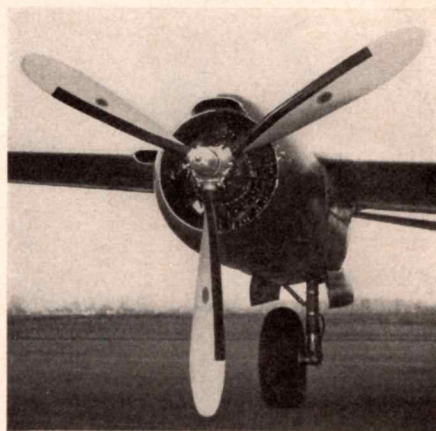
SPECIFICATIONS: No. of blades 4; diam. 16 ft 8 in; weight 883 lbs; hollow steel blades; blade pitch variable, including feathering and reversing; pitch change electric; pitch range 120°; engine shaft SAE 60 spline.

NOTEWORTHY FEATURES

It includes automatically synchronized constant-speed and auxiliary selective-pitch controls. As installed on the Boeing B-50 *Super-Fort*, Boeing



YC-97 cargo transport, Boeing Model 377 *Stratocruiser*, Martin JRM-2 and R-60-1, the blades are de-iced electrically.



HAMILTON STANDARD

Hydromatic Model 43D60

T. C. No. 851

PERFORMANCE: Max. *hp* (except takeoff) 2500; max. *rpm*.

SPECIFICATIONS: No. of blades 3; diam. 10 to 13 ft; weight varies with blade design; aluminum blades; blade pitch variable, feathering and reversible; pitch change hydraulic; engine shaft SAE 60 spline.

NOTEWORTHY FEATURES

A newer version of the Hydromatic which offers quick-reversing and more rapid constant-speed response and feathering action. It incorporates inverted standard actuating mechanism and other improvements and is used by most Douglas DC-6 transports. SAE 50 spline versions are installed on the Canadair Four, Canadair C-54-GM and Grumman JR2F.

HAMILTON STANDARD

Hydromatic Model 34D60

T. C. No. 856

PERFORMANCE: Max. *hp* (except takeoff) 2500; max. *rpm* (except takeoff) 1341.

SPECIFICATIONS: No. of blades 4; diam. 10 to 13 ft; weight varies with blade design; aluminum blade; blade pitch variable, feathering and reversible; pitch change hydraulic; engine shaft SAE 60 spline.

NOTEWORTHY FEATURES

Currently used in SAE 50 spline version on the Canadair DC-4M2. The same propeller in SAE 51 spline version 34D51, is standard equipment for the SAAB 90A-2.

HAMILTON STANDARD

Hydromatic Model 23E50

T. C. No. 603

PERFORMANCE: Max. *hp* (except takeoff) 1625; max. *rpm* (except takeoff) 2100.

SPECIFICATIONS: No. of blades 3; diam. 8 ft

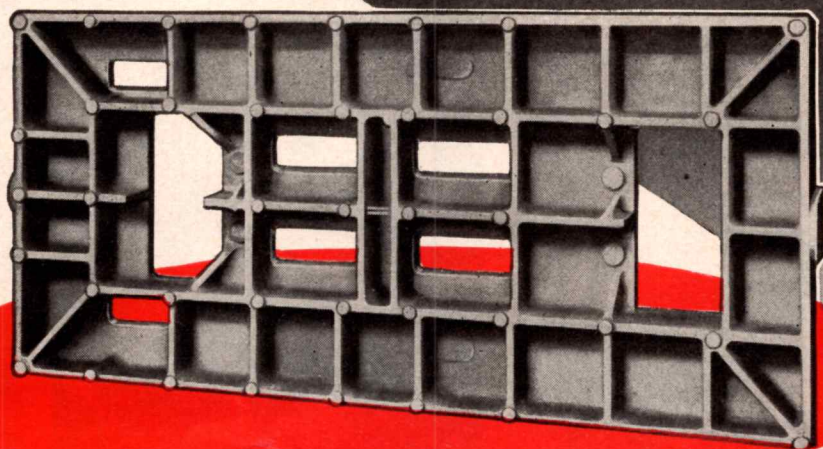
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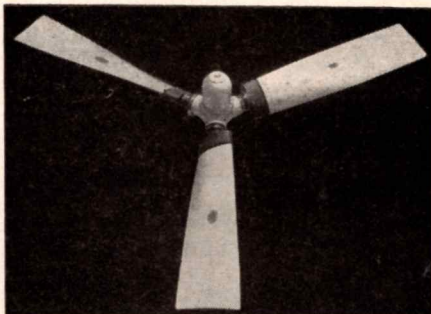
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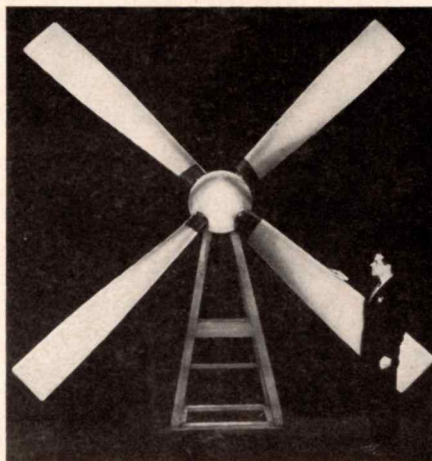
6 in to 15 ft; weight varies with blade design; aluminum blade; blade pitch variable with feathering; pitch change hydraulic; engine shaft SAE 50 spline.

NOTEWORTHY FEATURES

Most extensively used aircraft propeller; installed on domestic commercial airliners just before and during the war and on many wartime bombers, fighters and transports. Standard for all Douglas DC-3 and DC-4 transports.



low steel blades, lightest for propellers over 13 ft in diam.; one-piece barrel, quick feathering, two-to three-second reversing, and internal electric de-icing. Wide square-tipped blades give improved thrust and power absorption. Installed on Martin 202, Consolidated Vultee *Convair-Liner*, Lockheed P2V *Neptune*, Chase XC-123 and some Douglas BC-6 transports, and on Sud Ouest S030P. Available in SAE 50 and 51 splines.



HAMILTON STANDARD Hydromatic Model 24260 T. C. No. 870

PERFORMANCE: Max. *hp* (except takeoff) 3500; max. *rpm* (except takeoff) 960.

SPECIFICATIONS: No. of blades 4; diam. 12 ft 6 in to 17 ft; weight varies with blade design; steel blades; blade pitch variable, feathering and reversible; pitch change hydraulic; engine shaft SAE 60 spline.

NOTEWORTHY FEATURES

Largest propeller produced by Hamilton Standard. Equips the following planes: most Boeing 377 *Stratocruisers*; the Sud-East 2010; all Fairchild C-119 and R4Q *Packets*; Boeing C-97 *Stratofreighter*, North American AJ, Martin AM-1 and P4M, Douglas YC-124A.



HAMILTON STANDARD Controllable Model 2B20 T. C. No. 255

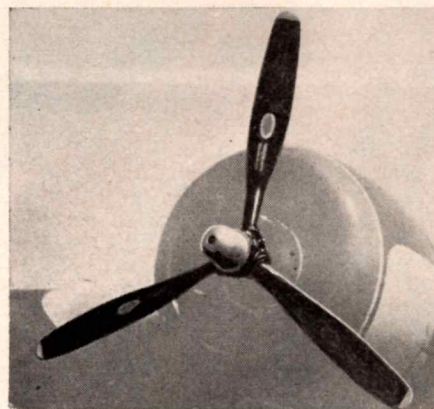
PERFORMANCE: Max. *hp* (except takeoff) 350; max. *rpm* (except takeoff) 2450.

SPECIFICATIONS: No. of blades 2; diam. 6 ft to 9 ft 6 in; weight varies with blade design; aluminum blades; blade pitch variable; pitch change hydraulic; engine shaft SAE 20 spline.

NOTEWORTHY FEATURES

Only Controllable-counterweight Hamilton Stand-

ard propeller in production; available for such aircraft as Cessna 190 and 195. It may be used as either a two-position propeller operated by the pilot, or a controlled constant-speed propeller. Pitch change is actuated hydraulically in conjunction with counterweights.



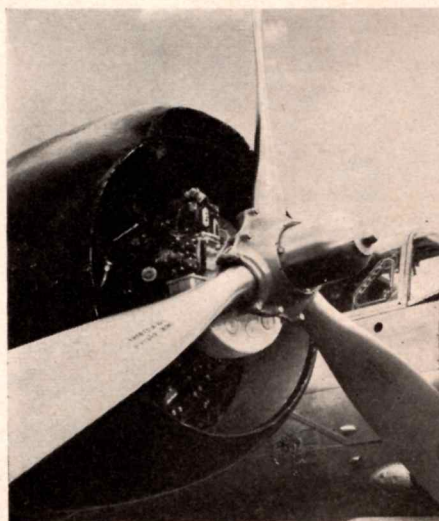
HAMILTON STANDARD Model 23D40 T. C. No. 719

PERFORMANCE: Max *hp* (except takeoff) 900; max. *rpm* (except takeoff) 2200.

SPECIFICATIONS: No. of blades 3; diam. 8 to 13 ft; weight varies with blade design; aluminum blade; pitch variable with feathering; pitch change hydraulic; engine shaft SAE 40 spline.

NOTEWORTHY FEATURES

Three-blade version of the smaller feathering Hydromatic, current standard equipment for Grumman *Mallard* amphibians.



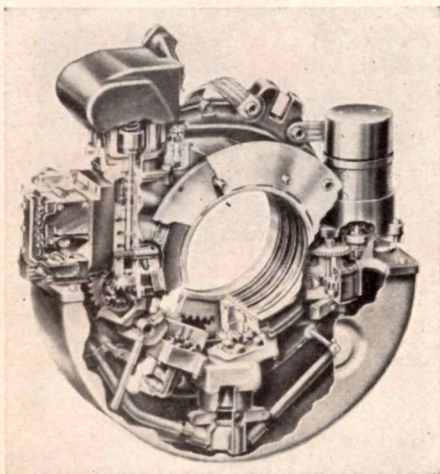
HAMILTON STANDARD Hydromatic Model 43E60 T. C. No. 871

PERFORMANCE: Max. *hp* (except takeoff) 2500; max. *rpm* (except takeoff) 1341.

SPECIFICATIONS: No. of blades 3; diam. 11 ft 6 in to 15 ft; weight varies with blade design; aluminum blades; blade pitch variable, feathering and reversible; pitch change hydraulic; engine shaft SAE 60 spline.

NOTEWORTHY FEATURES

Hamilton Standard's latest Reversing Hydromatic; standard equipment for Lockheed L-749A *Constellations*. To be installed on the Breguet 763. New blade design for improved takeoff and climb.



HAMILTON STANDARD Integral Oil Control Assembly

A self-contained oil supply and accuracy section unit for Hydromatic propellers; for use where operations requiring use of engine oil may not be desirable. Assembly comprises a complete accessory unit and a tank to hold the propeller oil. Mounted at the rear of the propeller hub, it concentrates all fundamental operating functions into one compact section. Hydraulic pumps, governor, auxiliary motor for feathering and reversing and control valves are contained in this single unit.

NOTEWORTHY FEATURES

Boeing C-97, Fairchild C-119, Chase XC-123 and Grumman SA-116 are equipped with this new development.

HAMILTON STANDARD Hydromatic Model 23260 T. C. No. 853

PERFORMANCE: Max. *hp* (except takeoff) 3000; max. *rpm* (except takeoff) 1225.

SPECIFICATIONS: No. of blades 3; diam. 12 ft 6 in to 17 ft; weight varies with blade design; steel blades; blade pitch variable; feathering and reversible; pitch change hydraulic; engine shaft SAE 60 spline.

NOTEWORTHY FEATURES

Improvements over earlier models, including hol-

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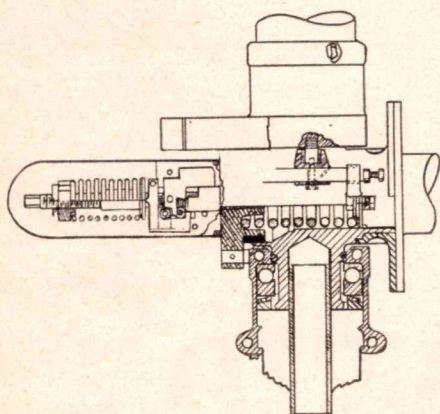
HAMILTON STANDARD Hydromatic Model 22D30 T. C. No. 736

PERFORMANCE: Max. *hp* (except takeoff) 600;
max. *rpm* (except takeoff) 2300.

SPECIFICATIONS: No. of blades 2; diam. 8 to 13 ft; weight varies with blade design; aluminum blades; blade pitch variable, feathering and reversible; pitch change hydraulic; engine shaft SAE 30 spline.

NOTEWORTHY FEATURES

Smallest Hydromatic model, having all Hydromatic features including automatic constant-speed control and quick feathering. Generally adaptable to aircraft in the 300- to 600-*hp* range such as Beechcraft D-18. A similar model, 22D40, has an SAE 40 spline, designed for engines up to 800 *hp*. Two-blade simplicity is retained and fairly high *rpm* is permissible.



HARTZELL Snap-O-Matic Model HC52X20 T. C. No. 3P2-1

PERFORMANCE: Max. *hp* (except takeoff) 215;
max. *rpm* (except takeoff) 2600.

SPECIFICATIONS: No. of blades 2; diam. 78 to 86 in; weight 61; aluminum and plastic blades; blade pitch variable; pitch change automatic; engine shaft SAE 20 spline.

NOTEWORTHY FEATURES

Used on Ryan Model L-17.



HARTZELL Plastic Adjustable Model HA12 T. C. No. 824

PERFORMANCE: Max. *hp* (except takeoff) 100;
max. *rpm* (except takeoff) 3000.

SPECIFICATIONS: No. of blades 2; diam. 68 to 74 in; weight 17 lbs; plastic blades; blade pitch ground adjustable; pitch change ground adjustable; engine shaft tapered and flanged.

NOTEWORTHY FEATURES

Can be installed on most small aircraft below listed *hp* and with same static *rpm* limits as wood propeller.

HARTZELL Snap-O-Matic Model HC42XF T. C. No. 3P1-1

PERFORMANCE: Max. *hp* (except takeoff) 215;
max. *rpm* (except takeoff) 2600.

SPECIFICATIONS: No. of blades 2; diam. 78 to 86 in; weight 59 lbs; aluminum and plastic blades; blade pitch variable; pitch change automatic; engine shaft flanged.

NOTEWORTHY FEATURES

Used on the Luscombe and Sky Sedan Model 11A.



HARTZELL Hydro-Matic Model HC12X20 T. C. No. 845

PERFORMANCE: Max. *hp* (except takeoff) 240;
max. *rpm* (except takeoff) 2600.

SPECIFICATIONS: No. of blades 2; diam. 106 to 102 in; weight 60 to 72 lbs; aluminum and plastic blades; blade pitch variable and reversible; pitch change hydraulic; engine shaft SAE 20 spline.

NOTEWORTHY FEATURES

Installed on Aero Commander Model L3805; Bellanca; Beech: Bonanza Model 35; Fairchild Model F-47, 24R46-5&A, PT-19, PT-26; Grumman Widgeon, Models G44 and G44A; Johnston Bullet, Model 185; Piper proposed Skysedan and Twin Engine; Ryan Navion, L-17 or NAV-4; Stinson L-5.

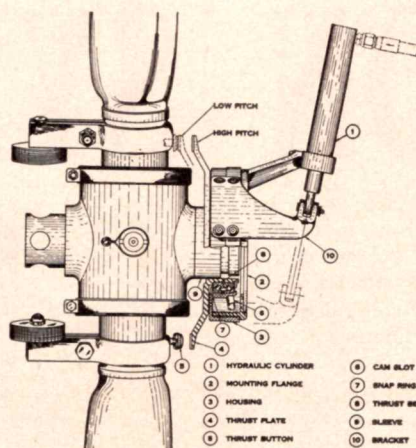
HARTZELL Ground Adjustable Model HA12UF/8032-6 T. C. No. 824

PERFORMANCE: Max. *hp* (except takeoff) 145;
max. *rpm* (except takeoff) 2800.

SPECIFICATIONS: No. of blades 2; weight 20 lbs; plastic blade; blade pitch ground adjustable; pitch change ground adjustable; engine shaft tapered and flanged.

NOTEWORTHY FEATURES

Used on the Meyers Airplanes.



KOPPERS Aeromatic Model 220H T. C. 833

PERFORMANCE: Max. *hp* (except takeoff) 240;
max. *rpm* (except takeoff) 1925.

SPECIFICATIONS: No. of blades 2; diameter 7 ft 9 in; weight 74.7 lbs. Steel-tipped, plastic-covered wooden blades; pitch variable, semi-feathering; pitch change automatic, hydraulic optional. SAE 20 spline.



NOTEWORTHY FEATURES

Approved for Ryan Navion. Equipped with hydraulic device fitted to standard models permitting pitch regulation at high altitudes. Control supplements automatic operation by providing selectivity. Also available for Bellanca, Stinson L-5; approvals pending for other aircraft. *Strato-Cruise Control* optional.



KOPPERS Aeromatic Model F200H T. C. 820

PERFORMANCE: Max. *hp* (except takeoff) 165;
max. *rpm* (except takeoff) 2650.

SPECIFICATIONS: No. of blades 2; diameter 6 ft 4 in; weight 40 lbs. Setel-tipped, plastic-covered wooden blades; pitch variable, semi-feathering; pitch change automatic, hydraulic optional. Engine shaft: flanged; SAE spline Nos. 1, 2, 3.

NOTEWORTHY FEATURES

Approved for Aeronca, Bellanca, Cessna, Ercoupe, Goodyear, Piper, TEMCO and similar foreign aircraft. *Strato-Cruise Control* optional; extra-heavy blade-tipping for amphibian or seaplane installation available.



McCAULEY Met-L-Prop Model 1A90/1B90/1C90 T. C. No. 842

PERFORMANCE: Max. *hp* (except takeoff) 108;
max. *rpm* (except takeoff) 2800.

SPECIFICATIONS: No. of blades 2; diam. 66 to 78 in; weight 21 lbs; aluminum blades; blade pitch fixed; engine shaft tapered and flanged.



NOTEWORTHY FEATURES

Approved for Aeronca, Cessna, Commonwealth, Ercoupe, Funk, Luscombe, Piper, Stinson, Taylorcraft. First aluminum-alloy propeller for small personal planes. Upper illustration shows model 1A90. Lower shows models 1B90 and 1C90.



McCAULEY Met-L-Prop Model 1A170 A. T. C. No. 857

PERFORMANCE: Max. *hp* (except takeoff) 165;
max. *rpm* (except takeoff) 2800.

SPECIFICATIONS: No. of blades 2; diam. 72 to 84 in; weight 32 lbs; aluminum blades; blade pitch fixed; engine shaft flanged.

NOTEWORTHY FEATURES

Only metal propeller available in the 145-165 *hp* range. Installed on Aeronca 15AC, Cessna 170 and Stinson Voyager.



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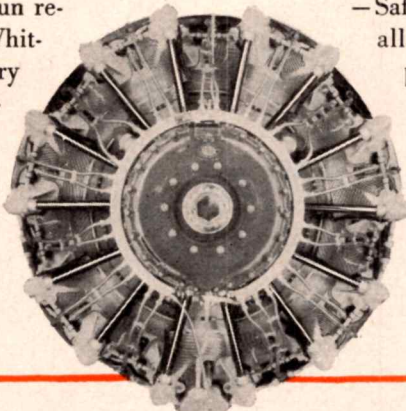
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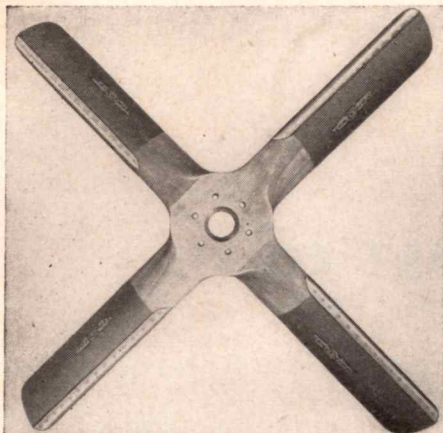
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SENSENICH Test Club

PERFORMANCE: Max. *hp* 40 to 5000; max. *rpm* 3000.

SPECIFICATIONS: No. of blades 2 or 4; diam. 40 to 110 in; weight 20 to 500 lbs; wood blade; blade pitch fixed; engine shaft tapered and flanged, SAE 10, 20, 30, 40, 50 and 60 spline.

NOTEWORTHY FEATURES

Fixed-pitch wood test club, with fabric and metal tipping.



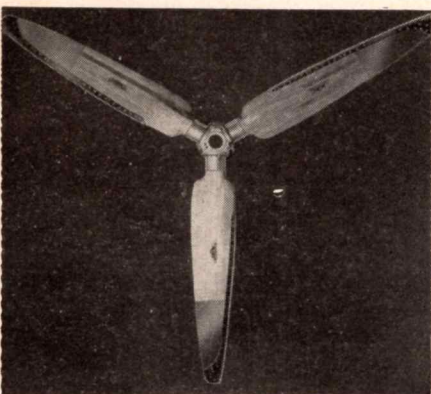
SENSENICH Conventional Two-blade

PERFORMANCE: Max. *hp* (except takeoff) 40 to 250; max. *rpm* (except takeoff) 2800.

SPECIFICATIONS: No. of blades 2; diam. 60 to 102 in; weight 7 to 31 lbs; wood blades; blade pitch fixed; engine shaft tapered and flanged; SAE 10 to 20 spline.

NOTEWORTHY FEATURES

Conventional wood, fixed pitch, two-blade propeller.



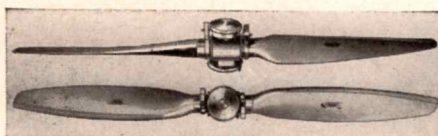
SENSENICH Ground Adjustable

PERFORMANCE: Max. *hp* (except takeoff) 75 to 165; max. *rpm* (except takeoff) 2800.

SPECIFICATIONS: No. of blades 3; diam. 60 to 80 in; weight 20 to 35 lbs; wood blade; blade pitch ground adjustable; engine shaft tapered and flanged.

NOTEWORTHY FEATURES

Three-blade, ground-adjustable propeller with vertical-laminated wood blades, conventionally tipped with fabric and metal.



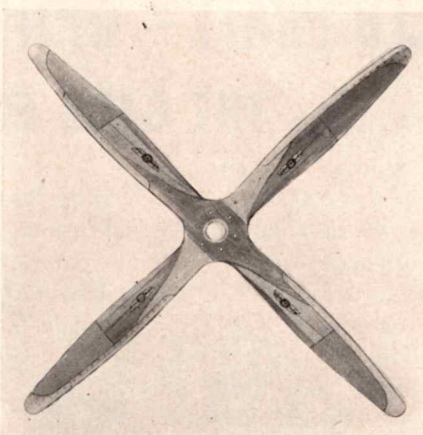
SENSENICH Sky blade

PERFORMANCE: Max. *hp* (except takeoff) 85 to 165; max. *rpm* (except takeoff) 2800.

SPECIFICATIONS: No. of blades 2; diam. 70 to 78 in; weight 25 to 35 lbs; blade pitch variable; pitch change hydraulic; engine shaft flanged.

NOTEWORTHY FEATURES

Hydraulically-operated, two-position, controllable-pitch propeller with wood blades, plastic covered and metal tipped. Approved constant-speed propeller, used with Woodward Constant Speed governors.



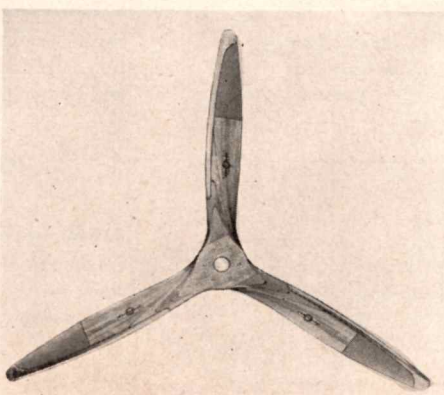
SENSENICH Fixed Pitch 4-Blade

PERFORMANCE: Max. *hp* (except takeoff) 75 to 180; max. *rpm* (except takeoff) 2800.

SPECIFICATIONS: No. of blades 4; diam. 48 to 78 in; weight 12 to 30 lbs; wood blade; blade pitch fixed; engine shaft tapered and flanged, SAE 10 or 20 spline.

NOTEWORTHY FEATURES

Wooden, fixed pitch, four-blade.



SENSENICH Fixed Pitch 3-Blade

PERFORMANCE: Max. *hp* (except takeoff) 85 to 165; max. *rpm* (except takeoff) 2800.

SPECIFICATIONS: No. of blades 3; diam. 70 in; weight 16 lbs; wood blade; blade pitch fixed; engine shaft tapered and flange, SAE 10 or 20 spline.

NOTEWORTHY FEATURES

Wooden, fixed pitch, three blade.



SENSENICH Metal

PERFORMANCE: Max. *hp* (except takeoff) 65 to 125; max. *rpm* (except takeoff) 2800.

SPECIFICATIONS: No. of blades 2; diam. 70 to 76 in; weight 22 to 28 lbs; aluminum blades; blade pitch fixed; engine shaft tapered and flanged.

NOTEWORTHY FEATURES

Conventional metal, fixed-pitch, two-blade propeller.



SENSENICH Hollow-Shell Spinner

PERFORMANCE: Max. *hp* (except takeoff) 65 to 250; max. *rpm* (except takeoff) 2800.

SPECIFICATIONS: No. of blades 2; diam. 63 to 102 in; weight 10 to 30 lbs; blade pitch fixed; engine shaft tapered and flanged, SAE 10 or 20 spline.

NOTEWORTHY FEATURES

Wood, fixed-pitch, two-blade propeller with integral hollow plywood shell spinner.



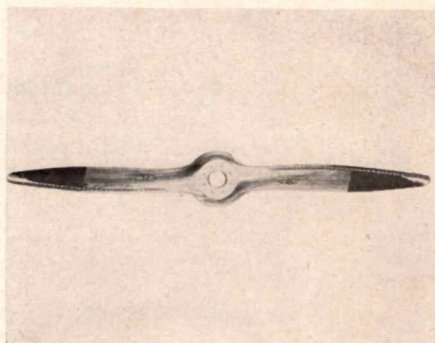
SENSENICH Ground Adjustable

PERFORMANCE: Max. *hp* (except takeoff) 65 to 90; max. *rpm* (except takeoff) 2600.

SPECIFICATIONS: No. of blades 2; diam. 70 to 76 in; weight 17 to 20 lbs; wood blade; blade pitch ground-adjustable; engine shaft tapered and flanged.

NOTEWORTHY FEATURES

Two-blade, ground adjustable, with vertical-laminated wood blades, conventionally tipped with fabric and metal.



SENSENICH Solid Spinner

PERFORMANCE: Max. *hp* (except takeoff) 65 to 250; max. *rpm* (except takeoff) 2800.

SPECIFICATIONS: No. of blades 2; diam. 60 to 102 in; weight 10 to 50 lbs; wood blades; blade pitch fixed; engine shaft tapered and flanged, SAE 10 or 20 spline.

NOTEWORTHY FEATURES

Wood, fixed pitch, two-blade propeller with integral solid wood spinner.

U. S. PROPELLERS

PERFORMANCE: Variable.

SPECIFICATIONS: Custom-made propellers for specific aircraft powered by specific engines. Single and multi-blade units with diameters up to 12 ft. Fixed, adjustable and variable pitch with electric actuation.

Honor Pratt & Whitney

TWO record certificates of award have been presented by the Federation Aeronautique Internationale to the Pratt & Whitney Aircraft Div. of United Aircraft Corp.

The honors are conferred for the design and manufacture of the R-2800 *Double Wasps* and the R-4360 *Wasp Major* engines used in establishing a U.S. intercity speed record between Chicago and Miami and between San Francisco and Washington, D.C.

New Maintenance Service

THE formation of Aircraft Maintenance International, Inc., an organization devoted to the service of airline aircraft on a contract basis, has been announced by Everett H. Schroeder, president.

Offices of the company are in New York, and accessory overhaul is being done at a temporary base in Jamaica, N. Y. Negotiations are under way with the Port of New York Authority for space for temporary and long-term facilities at New York International Airport.

Alabama Air Markers

ALABAMA'S current air-marking project shows that 110 new markers had been completed as of Dec. 1. Markers are being flight checked as completed. Old markers at points where airports have been abandoned, or pointing to abandoned airports, also are being corrected.

The total project calls for 140 new markers, at a cost of \$5,460 and is being paid for by the Alabama Department of Aeronautics.

Fairchild Takes Over

Fairchild Engine and Airplane Corp. has purchased the land and buildings currently occupied by four of its divisions at Farmingdale, L. I., N. Y., from the War Assets Administration for \$1,125,000.

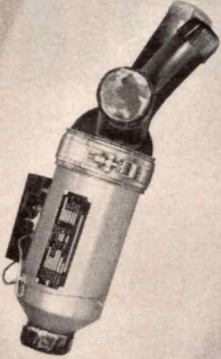
The property consists of approximately seven and a quarter acres of land with buildings containing 318,716 sq ft of floor space. Machinery, equipment, furniture and fixtures in use by Ranger Engines, Al-Fin, Stratos and Pilotless Planes Divisions of Fairchild in May 1947 (when negotiations for the property were begun) are also included.

On Antihistamines

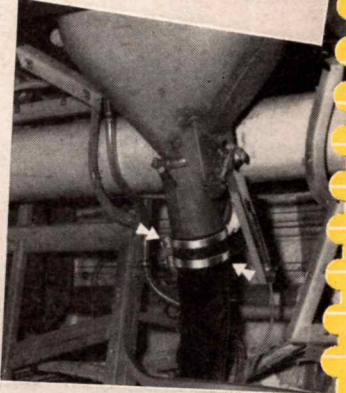
THE CAA's Medical Division has cautioned pilots against the use of antihistamine drugs. Pilots using these preparations, according to the statement, should not operate an airplane unless they are certain that, in them as individuals, the drugs cause no side reactions, such as drowsiness or dizziness.

These drugs are safe when taken in recommended dosages, it is declared further, but some individuals may be particularly susceptible.

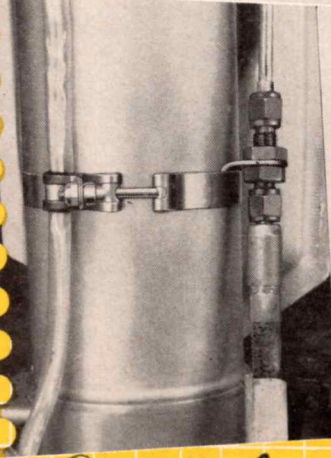
ENGINEERS NOTEBOOK



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Slipstream: Autobiography of an Air Craftsman. By Eugene E. Wilson. 328 pp; index. \$4.50.—Wilson has given a personalized chronological story of civil and military aviation as he lived it. His accurate reporting of historic events in which he participated gives the reader an insight of important milestones in the production of airplanes and powerplants. As president of United Aircraft Corp. and then Chairman of the Board of Governors of the Aeronautical Chamber of Commerce, the author was in advantageous positions from which to observe aviation's rapid advance. Engineering executives seldom produce such a human story spiced with interesting intimate dialogue worthy of a movie or radio script. Since he was associated with many of aviation's best-known officials in the 25-year span covered, his carefully detailed account serves as a valuable historical reference of names, dates and accomplishments.

My Three Years in Moscow. By Lieut. Gen. Walter Bedell Smith. 346 pp; illus; index. \$3.75.—A forceful and revealing study of the Communist machine at its topmost level by the United States Ambassador to Russia from March, 1946, to March, 1949. Considerably more impersonal and necessarily less localized than Gen. Howley's *Berlin Command*, it is nevertheless a sharp picture of the Russian people and a rationalization of their attitude towards America. The carefully written if somewhat restrained text is very readable and, perhaps, is just the sort of commentary that is needed in a highly emotional situation such as exists in our present relations with the Soviet Union. No one can read these pages attentively without being illuminated and confirmed in his opinion that Russia is the greatest present menace to American liberty. Because Russia is the enemy, this thoughtful book, explaining the nature of the beast, is must reading.

Engineers' Dictionary: Spanish-English and English-Spanish. By Louis A. Robb. 664 pp. \$12.50.—Second edition of a highly useful work first published in 1944, considerably revised and expanded in the light of recent developments—such as those in aerial photographic mapping, soil mechanics and airport construction—and in a further effort to provide equivalents for special phrases as well as for single words. Because a rule

has been to supply equivalents rather than definitions, the author has been able to pack in an exceptional number of terms, and the publisher has aided in giving them effective presentation in clear, easily readable type. The fact of a second edition is eloquent proof of the esteem in which this reference book is held.

Aircraft Structures. By David J. Perry. 566 pp; illus; bibliographical references; tables; index. \$6.50.—The author, who is professor and head of the department of aeronautical engineering at the Pennsylvania State College, has endeavored to supply a dissertation which is sufficiently fundamental to meet future situations even for a long time to come. Time alone can justify this claim, but indications are very much on the author's side. Heavy emphasis is placed at the start on the application of the elementary principles of mechanics to the analysis of aircraft structures, the problems of deflections and statically indeterminate structures being treated in later chapters. Most of the theory is applicable to any design requirements and for any materials, the design engineer thereafter being able to supplement the theory with the detail design specifications and material properties that are applicable to his particular craft.

Selling to the Federal Government. Prepared by the Editorial Staff of the Bureau of National Affairs. 348 pp; appendices; index. \$5.—A detailed account of requirements and regulations, well classified for ready reference and printed in crisp large type. Appendices present the Federal Property Administrative Services Procurement Act, and Armed Services Procurement Regulations. Should be exceedingly useful to those desiring such information—and obviously there are many such in the aviation industry.

Jet Aircraft Simplified. By Charles Edward Chapel. 160 pp; illus; index. Flexible cover, \$2.75; hard cover, \$3.75.—Described as the first popular book to cover jet aircraft comprehensively, intended to be used also as a text in high schools and junior colleges. The author, well known for his success in preparing training texts on aviation, has produced a well-organized and profusely illustrated treatment of his subject and has presented his details with customary clarity. The book should serve its purpose very well indeed.

Jane's All the World's Aircraft: 1949-1950. Compiled and edited by Leonard Bridgman. Approx. 750 pp; illus; index. \$16.50.—Because this edition, marks the 40th anniversary of this celebrated compendium, each major section is prefaced with a retrospective introduction written by an authority. Otherwise, the material retains its familiar character of presentation save that there has been some improvement in type and column arrangement in certain parts. The worldwide coverage—not excluding Russia—is rich as to new developments, with revisions of older records, all attesting the enormous amount of attention and hard work required to prepare this latest issue and to keep it so handsomely up to standard.

The Aircraft Year Book for 1949. 464 pp; illus. \$6.—31st annual edition of one of the most useful publications in aviation, official year book of the Aircraft Industries Assn. of America. Admirable in scope and coverage, it shows numerous evidences of painstaking research and careful editing. The twelve months of 1949 obviously were among the most difficult of interpretation since the Wrights flew in 1903, but the recital here is intelligent, informing and compact. A day-by-day chronology of the aeronautical year, biographical briefs concerning personalities, a directory section, official records and summary statistics supplement the broader account of developments in planes, powerplants and accessories.

Development of Aircraft Engines. By Robert Schlaifer. **Aviation Fuels.** By S. D. Heron. One volume. 754 pp; technical appendix; indices, \$5.75.—Two studies of the relations between Government and industry, tracing private enterprise using its own resources, industry financed by public funds, original research by Government, and co-operative activity among the engine and oil industries and Government units, especially the Armed Forces. Schlaifer, assistant professor of business administration at the Harvard Business School, traces the history of specific engine developments in the U.S., Britain and Germany to throw light on questions of policy and incentives and to form a basis for conclusions on the workability of certain types of Government-industry methods of joint accomplishment; Heron, a distinguished consulting engineer

in Detroit, develops the inter-relationships of new engine developments with improved fuels, particularly fuels that can be manufactured in quantity at reasonable cost. Obviously a book of great immediate importance and value to this industry. Well written and thorough.

Carbide Cutting Tools: How to Make and Use Them. By Warren Baker and Joseph S. Kosacka. 416 pp; illus; bibliography; index. \$5.50.—The ever-increasing use of carbide as a cutting edge for tools has occasioned this comprehensive work on the subject, apparently the first of its kind. The authors have been industrious in accumulating relevant information and in adding importantly to it, and the organization of their material for easy and satisfying reference concerning design, manufacture, use and maintenance is praiseworthy indeed. Baker is former executive editor of *Science and Mechanics* and Kosacka is associate professor of engineering at the University of Illinois.

Fluid Pressure Mechanisms. By H. G. Conway. 218 pp; illus; index. \$5.—A classification and fundamental description of more than 500 hydraulic, pneumatic and compressed-gas systems of high, medium, and sometimes low, pressure. The work is concerned not with detailed design or constructional features of the equipment, but with the essential principles of the various devices, how they work and how they differ. The approach is admirable, and the presentation, including the simplified diagrams, is equally to be commended for clarity and over-all effectiveness.

Electronic Navigation. By Leonard M. Orman. 222 pp; illus; glossary; bibliography; index. \$4.50.—Written by the director of the Army Radar Laboratory at West Point Academy, and described as the first book available to the general public in which the entire field of electronics is considered in terms of aircraft and marine navigation. It tells, basically, how radar and loran are used as position-fixing facilities and surveys the many new electronic derivatives that are changing the ancient art of navigation so radically. Included among the latter are the radio altimeter, ILS and GCA, the forthcoming course-liner computer, distance-measuring instrument (DME), omniranges, tricon, shoran, R-Theta navigation, and such British developments as Decca, consol and gee.

Names in the News

*Personnel changes and
promotions in aviation
and allied industries*



Fettig



Kellhofer

- BURNHAM ADAMS, formerly vice-president of Lear, Inc. in charge of Lear Cal Div., has joined AiResearch Manufacturing Co. as sales manager.

- Allegheny Ludlum Steel Corp. announces that MERLE J. GRAHAM has been named manager of production; FRANK G. BENFORD, asst. manager of the company's West Leechburg, Pa. plant, was named to succeed Mr. Graham as plant manager.

- DANIEL E. ANDERSON has been appointed public relations director for the Los Angeles City Dept. of Airports.

- Bendix Aviation Corp. announces the election of GEORGE E. STOLL and C. S. HARDING MOTT to the board of directors.

- THEODORE F. BRICK has been appointed district manager of the Dayton office of Greer Hydraulics, Inc.

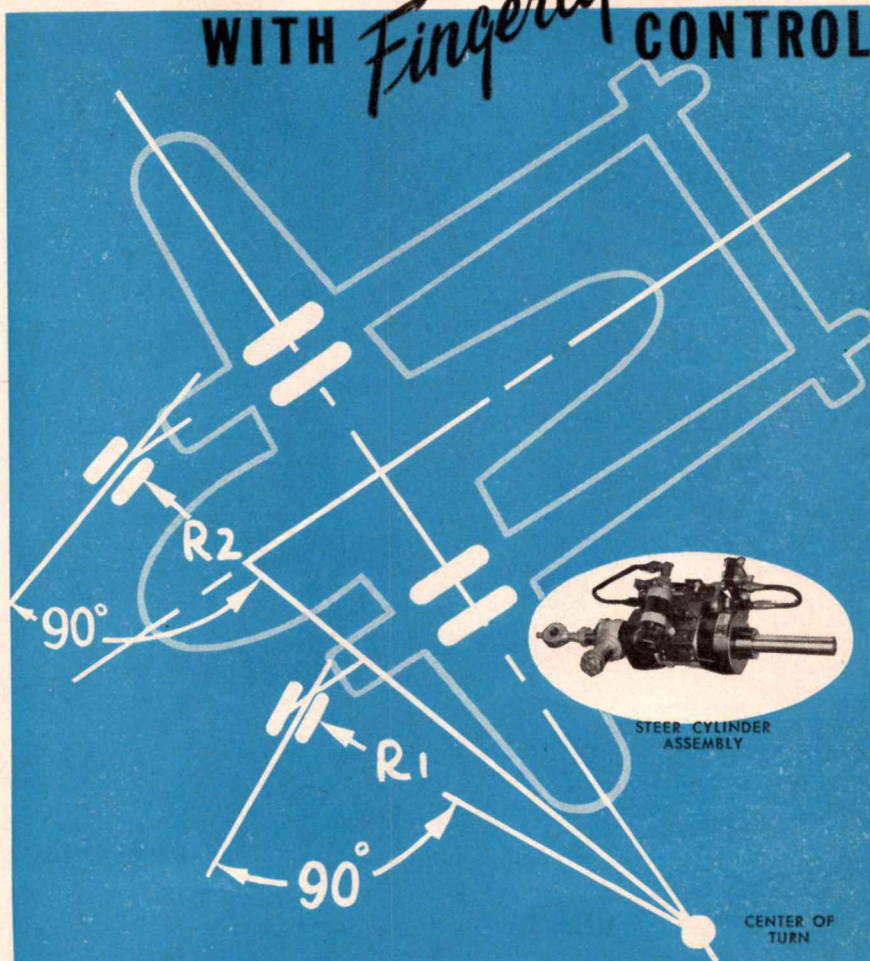
- ROBERT F. FETTIG has been appointed district manager of the Detroit and Michigan sales areas for Elastic Stop Nut Corp.

- ARTHUR C. HARVEY, president of Air-Parts, Inc., distributors of aviation supplies, marked the 19th anniversary of the company's founding.

- ROBERT W. KELLHOFER, formerly asst. to the chief of the

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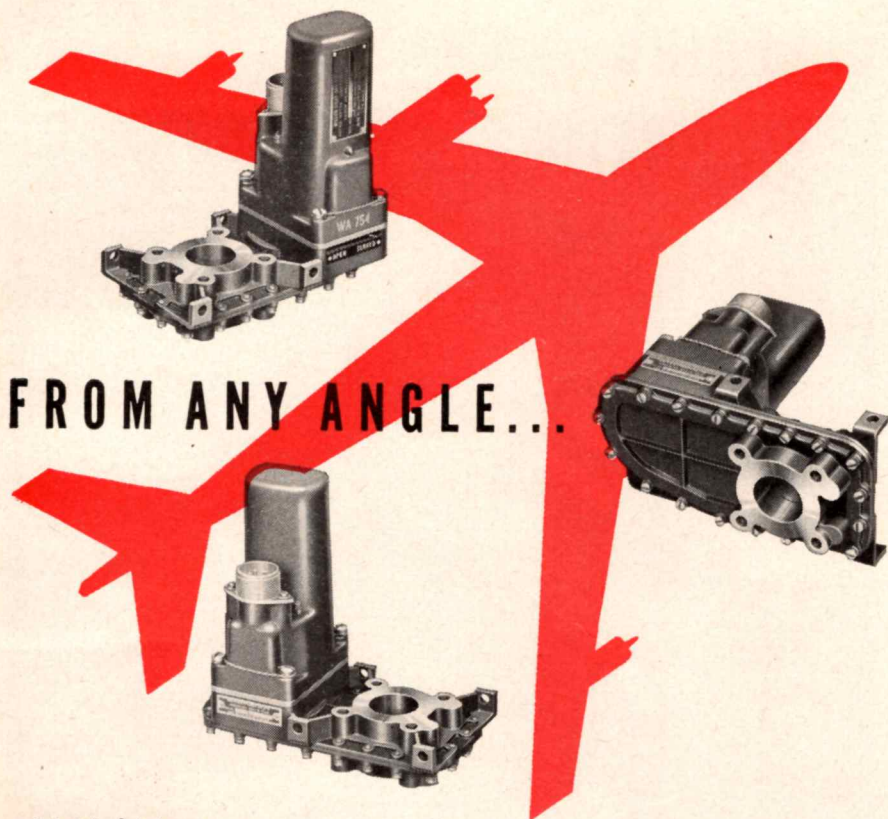
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Aircraft Section, Procurement Div., Air Material Command, has been named manager of the sales and service dept. of Fairchild Aircraft Div.

• CLEVELAND LANE has been named manager of the newly formed public relations division of Pennsylvania Salt Manufacturing Co.

• DONALD R. MORSE has been appointed controller of Wright Aeronautical Corp.

• SHERWOOD A. NICHOLS has been elected executive vice-president of Aircraft Engineering & Maintenance Co.

• PERRY W. PRATT has been appointed asst. chief engineer of Pratt & Whitney Aircraft Div. of United Aircraft Corp. He will have charge of the design and development of all of P&W's advanced engines.

• WALTER F. MUMFORD has been elected vice-president in charge of operations of American Steel & Wire Co.

• DAVID C. PETERSON has been named director of engineering and manufacturing of Division One of Stewart-Warner Corp.

• FRANK M. SALISBURY became engineering vice-president of Airborne Equipment Ltd., a new division of Carruthers and Fernandez, Inc. He was formerly project engineer in charge of aircraft hydraulics for Interstate Engineering Corp.

• ROY J. SANDSTROM has been named chief engineer of Bell Aircraft Corp.

• A. C. THOMPSON, formerly works manager of the Bartlett Hayward plant of the Koppers Co., Inc., has been promoted to production manager for the company's Metal Products Div.

• KEVIN G. WINKLER has been appointed sales engineer for Greer Hydraulics, Inc.

TECHNICAL BRIEFS

of the National Advisory Committee for Aeronautics

Theoretical Loading At Supersonic Speeds of Flat Swept-Back Wings With Interacting Trailing and Leading Edges. Doris Cohen. NACA Technical Note No. 1991, Dec. 1949.—By the method of superposition of conical flows, the load distribution is calculated for regions of a long, rectilinear, sweptback wing behind the points at which the Mach lines from the trailing-edge apex intersect the leading edge. It is found that a good approximation to the load can be obtained by the application of a fairly simple correction factor to the two-dimensional subsonic distribution. The similarity to two-dimensional flow is used to derive expressions for the loss of lift behind the Mach lines from the tips of the wings.

Annular-Jet Ejectors. Elliot G. Reid. NACA Technical Note 1949, Nov. 1949.—Model tests show that annular-jet ejectors induce approximately the same rates of secondary flow as do comparable central-jet types when both have non-divergent mixing tubes. However, when divergent mixing tubes are used, the flow rates for the annular type increase much more than do those for the conventional one. This dissimilarity is ascribed to suppression of the flow separation by the scouring action of the annular jet. Jet thrust was inconsequently augmented by annular-jet ejectors with straight mixing tubes and, despite the greater flow rates, the augmentation obtained with divergent mixing tubes still fell short of that previously demonstrated by the central-jet type with straight mixing tube.

Theoretical Relations Between the Stability Derivatives of a Wing in Direct and in Reverse Supersonic Flow. Sidney M. Harmon. NACA Technical Note No. 1943, Spet. 1949.—An investigation is made by means of the linearized theory to obtain relations between the stability derivatives of a wing and its reverse in supersonic flow. The wings investigated have a supersonic leading edge, a supersonic trailing edge and either supersonic side edges or supersonic nonreentrant side edges which are non-interacting. The investigation is made for thin flat-plate wings for steady vertical and longitudinal motions, steady rolling and pitching, and motions in which the wing is accelerated uniformly in the vertical direction.

Preliminary Investigation At Supersonic Speeds of Triangular and Sweptback Wings. Macon C. Ellis, Jr., and Lowell E. Hasel. NACA Technical Note No. 1955, Oct. 1949.—This article presents the results of a supersonic wind-tunnel investigation of a series of thin triangular and sweptback wings. The triangular-wing series consisted of eight triangular wings of vertex angles, such that a range of

A selection of recently published NACA Technical Notes, Technical Memoranda and hitherto Classified Wartime Reports is herewith presented. Similar abstracts in other fields will be provided from time to time.

leading-edge positions both inside and outside the Mach cone at the test Mach numbers of 1.43 and 1.71 was obtained. The three swept wings had angles of sweep of 45°, 55°, and 63° and were tested at Mach number 1.43.

Comparative Drag Measurements at Transonic Speeds of Rectangular and Sweptback NACA 65-009 Air-Foils Mounted On a Freely Falling Body. Charles W. Mathews and Jim Rogers Thompson. NACA Technical Note No. 1969, Oct. 1949. — Results are presented of directly comparable drag measurements of airfoils with rectangular planform and airfoils with a sweepback of 45°. The data were obtained through the use of the free-fall test technique. Both airfoils were identical in span, frontal area, and chord perpendicular to the leading edge. The data obtained were used to establish the relation between the airfoil drag coefficients and the free-stream Mach number over a range of Mach numbers from 0.90 to 1.27.

Summary of the Theoretical Lift, Damping - in - Roll, and Center-of-Pressure Characteristics of Various Wing Planforms at Supersonic Speeds. Robert O. Piland. NACA Technical Note No. 1977, Oct. 1949.—Information for the determination of the theoretical lift, damping-in-roll and center-of-pressure characteristics for a group of planforms at supersonic speeds was collected. This information is presented in three forms: first, equations; second, figures presenting generalized curves in which the quantities plotted are combinations of the geometric and aerodynamic parameters; and third, figures presenting curves for representative groups of specific configurations showing variations of the derivatives with Mach number.

A Radar Method of Calibrating Airspeed Installations on Airplanes in Maneuvers at High Altitudes and at Transonic and Supersonic Speeds. John A. Zaloveik. NACA Technical Note No. 1979, Nov. 1949.—This report describes a method of calibrating the static-pressure source of a pitot-static airspeed installation on an airplane in level flight, dives, and other maneuvers at high altitude and at transonic and supersonic speeds. The method involves principally the use of radar-phototheodolite tracking equipment. The various sources of error in the method are discussed and simple calibrations are included.

Aeration of Aircraft Lubricating Oils Over a Range of Temperature. W. W. Woods and J. V. Robinson. NACA Technical Note No. 1846, April 1949.—An investigation was conducted to demonstrate the existence of air emulsions in aeronautical lubricating oil at 100° C and to measure the amount of air in the emulsions. Air emulsions were produced with an electric kitchen mixer, a colloid mill, and gear-pump circulation. The greatest measured air content of any emulsion produced was 15% by volume with oil containing lubricating additives, whereas unmodified oil formed emulsions with up to 12% air. Emulsified aeration was reduced to 2% to 4% by the use of either Dow Corning Fluid Type 200 or a glycerol and Aerosol OT mixture.

Some Effects of Density and Mach Number on the Flutter Speed of Two Uniform Wings. George E. Castile and Robert W. Herr. NACA Technical Note No. 1949.—Present-day trends toward flight at high speeds and at high altitudes have led to increasing interest in the flutter speed at low densities and high Mach number. This paper presents the results of 66 experimental flutter tests made on two uniform, cantilever wing models. Both models were fluttered over wide ranges of density, Mach number, and wave length. The data have been corrected for compressibility and wave-length effects and plotted as a function of density.

A Comparison of Wing Loads Measured in Flight on a Fighter-Type Airplane by Strain-Gage and Pressure - Distribution Methods. William S. Aiken, Jr., and Donald A. Howard. NACA Technical Note 1967, Nov. 1949.—Flight-test results of pressure-distribution measurements of the span loading on a wing of a fighter-type airplane are presented and compared with strain-gage results and wind-tunnel tests. The flight tests cover a Mach-number range from 0.35 to 0.81 at a pressure altitude of about 30,000 ft. The flight and wind-tunnel span-loading data are separated into additional and basic air-load distributions. Some data obtained during stalls and buffet-ing are given.

Attempts to Defoam Existing Oils by Processing. J. W. McBain, J. V. Robinson, W. W. Woods, and I. M. Abrams. NACA Technical Note No. 1845, April 1949.—In an attempt to reduce foam-ing, lubricating oil was pro-

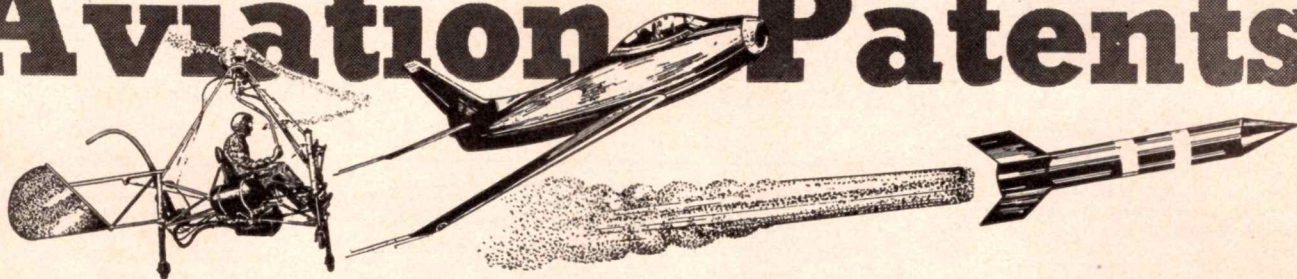
cessed by treatment with various adsorbents and by solvent extraction. Activated magnesium oxide, silica gel, and Porocel, when packed in columns through which Aeroshell was recycled, defoamed the oil somewhat but not to such an extent as did charcoal. Extraction of lubricating oils with liquid sulfur dioxide, phenol, and aqueous sodium hydroxide failed to produce any significant change in foaming. Finely divided sodium chloride, dispersed into the oil and then filtered out, did not affect foam stability.

Analysis of Means of Improving the Uncontrolled Lateral Motions of Personal Airplanes. Marion O. McKinney, Jr. NACA Technical Note No. 1997, Dec. 1949. — A theoretical analysis was made of means of improving the uncontrolled motions of personal airplanes. The investigation was conducted to determine whether such airplanes could be made to fly uncontrolled for an indefinite period of time without getting into dangerous attitudes and for a reasonable period of time (one to three minutes) without deviating excessively from their original course. The analysis indicates that the uncontrolled motions can be made safe as regards spiral tendencies and can be greatly improved as regards maintenance of course without resort to an autopilot.

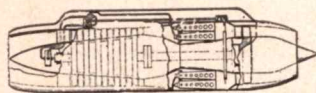
Linearized Lifting-Surface Theory for Sweptback Wings with Slender Planforms. Harvard Lomax and Max A. Heaslet. NACA Technical Note No. 1992, Dec. 1949.—The spanwise and chordwise distribution of loading, the lift, and the induced drag of a sweptback wing of slender planform are developed by means of linearized lifting-surface theory. The results are applicable for all free-stream Mach numbers. The term "slender" implies that the ratio of the reduced span (equal to the product of $[1 - (\text{Mach number})^2]^{1/2}$ and the span) to the over-all length of the wing is small.

Plastic Buckling of a Long Flat Plate Under Combined Shear and Longitudinal Compression. Eldridge Z. Stowell. NACA Technical Note No. 1990, Dec. 1949.—The condition for plastic buckling of a long flat plate under combined shear and longitudinal compression is obtained by using the theory of plastic buckling developed for simple loading, provided the ratio of shear and longitudinal compression is assumed constant during the loading process. The plastic may be restrained elastically along the edges. Combinations of shear and longitudinal compression are computed for three simply supported plates of 24S-T4 aluminum alloy, reduced to stress-ratio form, and compared with the known interaction curve in the elastic region.

Aviation Patents



Heat Exchanger. Alec George Henstridge, Bristol, England, assignor to The Bristol Aeroplane Co., (Ltd., Bristol, England. (2,479,071)

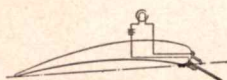


2,478,909

Turbine Apparatus. Charles D. Flagle, Swarthmore, Pr., assignor to Westinghouse Electric Corp., East Pittsburgh, Pa. (2,478,909) (Illustration)

Fla Detection Fluid. John M. Stokely, San Rafael, and George M. Cook, Berkeley, Calif., assignors to California Research Corp., San Francisco, Calif. (2,478,951)

Dolly Jack For Airplanes. Lional G. Connor, Washington, D. C. assignor to Connor Engineering and Manufacturing Co., Hyattsville, Md. (2,479,100)



2,478,967

Tilt Detector and Control For Gyroscopes. Hugh E. Webber, Williston Park, N. Y., assignor to The Sperry Corp. (2,478,956) **Stall Warning Device For Airplanes.** Leonard Greene, Mineola, N. Y. (2,478,967) (Illustration)

Celestial Navigation Computer. Waldo Emerson Randall, Jr., Cranston, R. I. (2,478,981)

Actuator Nut. Leonard Ochtman, Ridgewood, N. J. assignor to Bendix Aviation Corp., Teterboro, N. J. (2,479,019)

Rate Gyroscope. Henry Konet, Paramus, N. J., assignor to Bendix Aviation Corp., of Teterboro, N. J. (2,479,122)

Gas Turbine. Samuel W. Traylor, Jr., Allentown, Pa. (2,479,143)

Mount For Twin Floodlights. George E. Messe, East Cleveland, Ohio, assignor to General Electric Co. (2,479,176)

Plating Machine. John V. Davis, Detroit, Mich., assignor to the Udylyte Corp., Detroit, Mich. (2,479,323)

Composite Structure For Use In Aircraft Construction. Henry B. Gibbons, Stratford, and Eugene G. Zoldy, Ridgefield, Conn., assignors to United Aircraft Corp., East Hartford, Con. (2,479,342)

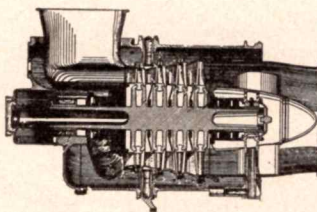
Bevel Gear Propeller Drive. Henry J. Rapuano, deceased, late of Milford, Conn., by Doris H. Rapuano, administratrix, New Haven, Conn., assignor to United Aircraft Corp., East Hartford, Conn. (2,479,406)

Asphaltic Jet Propulsion Fuel. Donald E. Carr, Los Angeles, Calif., assignor to Union Oil Co. of California, Los Angeles, Calif. (2,479,470)

Jet Propelled Airplane With Wing Discharge Slot. William Philip Goembel, Baltimore, Md. (2,479,487)

Direct Reading RDF. Gustav Guanelle, Zurich, Switzerland, assignor to Radio Patents Corp., New York, N. Y. (2,479,489)

Cathode Ray Artificial Horizon Indicator Circuit. Horace W. Babcock, Pasadena, Calif., assignor to the United States of America as represented by the Secretary of War. Filed July 9, 1945. (604,042)



2,479,038

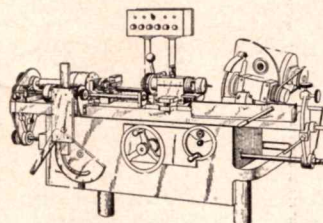
Turbine Construction. Val Cronstedt, Marlboro, Conn., assignor to United Aircraft Corp., East Hartford, Conn. (2,479,038) (Illustration)

Geiger-Muller Counter. Jan Bleeksma, Mount Vernon, N. Y., assignor by mesne assignments, to Philips Laboratories, Inc., Irvington on Hudson, N. Y. (2,479,201)

Torque Measuring Tool. Clement E. Gossling, Toronto, Ontario, Canada. (2,479,230)

Air-Cooled Generator. Harold Gustow Haas, Belleville, N. J., assignor to Bendix Aviation Corp., Teterboro, N. J. (2,479,233)

Internal-Combustion Engine Crankshaft and Gearing. Wilton G. Lundquist, Hohokus, N. J., assignor to Wright Aeronautical Corp. (2,479,245)



2,479,281

Grinding Machine. Walter Umbdenstock, Chicago, Ill., assignor to Lion Manufacturing Corp., Chicago, Ill. (2,479,281) (Illustration)

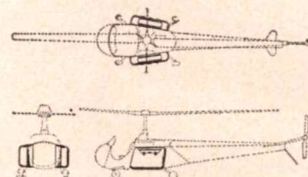
Automatic Pilot For Helicopter. Waldemar A. Ayres, Kew Gardens Hills, and Mortimer F. Bates, Brooklyn, N. Y., assignors to The Sperry Corp. (2,479,549)

Doppler Radar System. William Hansen, Garden City, N. Y., assignor to The Sperry Corp. (2,479,568)

Load Positioner. George V. Johnson, Portland, Oreg., assignor to Hyster Co., Portland, Oreg. (2,479,623)

Separable Airplane For Safe Flying. Dave Weisz, New York, N. Y. (2,479,655)

Hydraulic Actuator and Lock Unit. Arthur E. Kremiller, Glendale, Calif., assignor to Adel Precision Products Corp. (2,479,169)

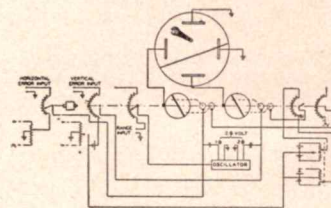


154,871

Helicopter Baggage Rack Design. Arthur W. Nelson, Niagara Falls, N. Y., assignor to Bell Aircraft Corp., Wheatfield, N. Y., Application Aug. 22, 1947 Serial No. 141,003 (154,871) (Illustration)

RDF Range Receiver. Herbert M. Wagner, Asbury Park, N. J., Filed Jan. 14, 1946. (641,162)

Airplane Pickup Device. John H. Connelly, Phoenix, Ariz., assignor to Southwest Airways Co. (2,479,316)



2,479,195

Robot Communication System. Luis W. Alvarez, Berkeley, Calif., assignor by mesne assignments, to the United States of America as represented by the Secretary of War. (2,479,195) (Illustration)

Duct System For Supercharged Engines. Robert Cramer, Jr., Hales Corners, Wis., assignor to Nordberg Manufacturing Co., Milwaukee, Wis., (2,479,318)

Radio Position Determining System. Ludlow B. Hallman, Jr., Dayton, Ohio, assignor to the U. S. A. as represented by the Secretary of War. (2,479,567)

Tire For Amphibious Airplanes and Vehicles. Rowland A. Bell, Miami, Fla. (2,479,714)

These patents, of interest to the aeronautical industry, were compiled from recent issues of the *Official Gazette* of the U. S. Patent Office. Copies of the individual patents in pamphlet form, may be obtained from the *Commission of Patents*, Washington, D. C., at a cost of 25 cents each.

Orders for Weber

THE WEBER AIRCRAFT DIV., Weber Showcase & Fixture Co., Inc., has announced an increase in its production of aircraft galleys through orders from Douglas Aircraft Co. New Douglas DC-6's, to be used by Delta Airlines, United Airlines and SABENA, will be equipped with Weber galleys.

Weber reports also a production order for a large quantity of new commercial-airline type pilot and crew seats for Lockheed Constellations.

Allegheny Ludlum Shifts

ELECTIONS by the board of directors of Allegheny Ludlum Steel Corp. have resulted in a revamped executive staff. H. G. Batcheller, company president, has been elected chairman of the board, being succeeded as president by E. B. Cleborne, executive vice-president.

Edward J. Hanley, vice-president of finances and treasurer, became executive vice-president. Clark W. King, vice-president, was elected treasurer. T. Ames Wheeler, manager of the cost and statistics dept., was named to the newly created office of controller.

Gift to Italy

THE WALTER MOTOR TRUCK CO. has furnished a complete Walter Snow Fighter for shipment to the village of Capracotta, Italy. The funds to purchase this snow-removal equipment were raised through a mammoth "Carnival for Capracotta" held at Jersey City, N. J. in December.

The 240-hp vehicle, of the type used extensively by state highway departments and counties in the U.S. and Canada, has a V Plow and right and left wings.

State Aid in Pennsylvania

THE Pennsylvania Aeronautics Commission has announced that the licensee of any commercially licensed airport in that state will be eligible to receive material assistance for projects, in the interests of safety, on the facilities on the state's airways system.

Expenditures will be made through the Commission, funds being derived from aviation-fuel taxes. The amount of assistance for any one airport will not exceed 50% of the liquid-fuel taxes paid at that airport, and will not be more than 50% of the total cost of the project.

"Airport Turfing"

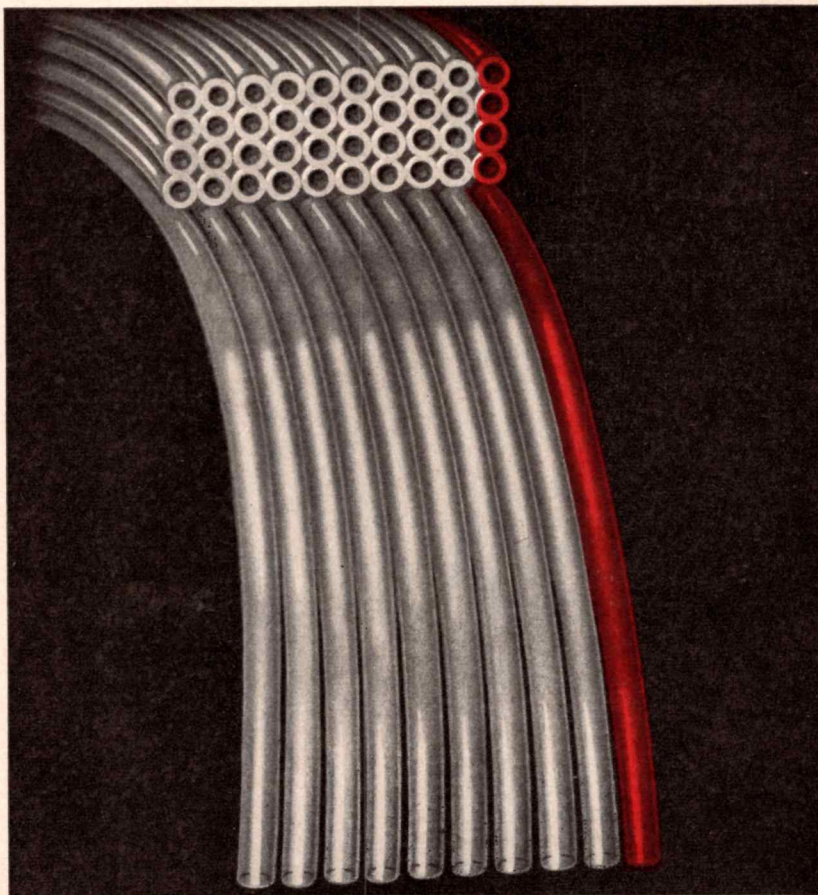
THE recently published CAA booklet, *Airport Turfing*, summarizes the knowledge and experience gained over the past few years in the development of turf at both military and civilian airports, and through experimental work by Federal and State agencies. Factors in planning turfed fields, soils, grading and draining, types of grasses to be used, and other related subjects are covered in this text.

It is available from the U. S. Government Printing Office, Washington 25, D. C., for 25c per copy.

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RESEARCH IN ROCKET AND JET PROPULSION*

DR. HSUE-SHEN TSIEN

Robert H. Goddard Professor, California Institute of Technology

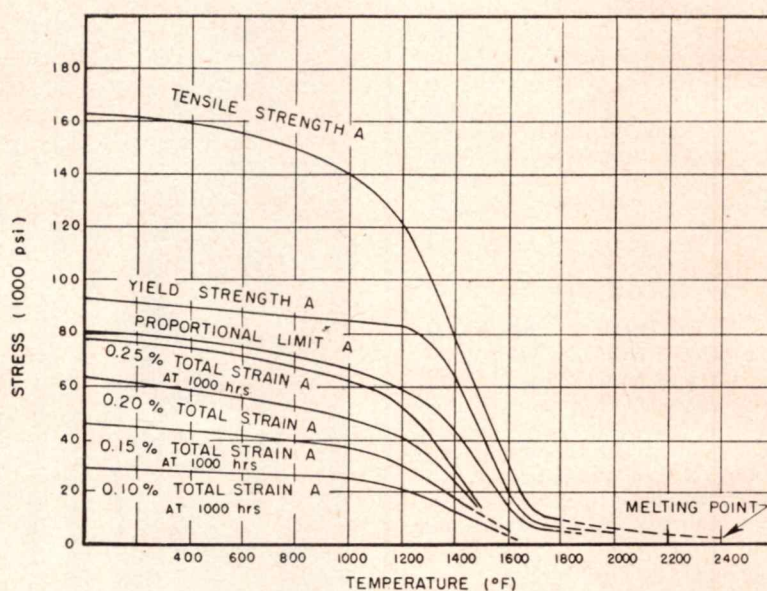
WHEN considering the problems of basic research in rocket and jet propulsion, it is profitable to keep in mind the salient features of rocket- and jet-propulsion engineering. These are: short duration of operation of the powerplant and extreme intensity of reaction in the motor.

That the duration of operation of the powerplant is short stems from the high specific consumption of the propellant. On the other hand, the dry weight of the rocket engine is much lower than that of other engines of equal output. Therefore, the total installation weight (the sum of dry weight and propellant consumed) can be lower than other powerplants if the duration of operation is short. (See *Ref. 1.*)

Furthermore, the specific consumption of rocket engines at all speeds, and of ramjet engines at supersonic speeds, in terms of *lb/hr/lbs* thrust, is essentially independent of flight speed. Therefore, the propulsive work done by the engine on the vehicle, per *lb* of fuel or propellant consumed, will be larger if the flight speed is larger. For this reason, it is advantageous to operate the rocket and the ramjet engine at large thrust and thus accelerate the vehicle to high speed.

The great kinetic energy of the vehicle at the end of the "burning time" of the powerplant is then utilized to achieve range by coasting. This form of dynamic trajectory is demonstrated to be superior to steady flight with long-drawn-out operation of the rocket and ramjet. Accordingly, all applications of these powerplants will involve intensive, but short-duration, operations of the engines.

The extreme intensity of reaction in the motor means high operating



STRENGTH vs. TEMPERATURE OF INCONEL X HEAT TREATED 4 hrs AT 2100°F, 24 hrs AT 1550°F, AND 20 hrs AT 1300°F

Figure 1

temperatures. To find materials which can withstand high stresses at high temperatures is the main material problem in rocket and jet-propulsion engineering. However, the problem here is different in one aspect from the material problem in turbojet and gas-turbine design. This is the short operating time of the unit. For expendable units, such as missiles, the operating time is generally of the order of minutes. Even for vehicles which are intended for repeated operation, it still is likely that the optimum performance will be obtained by a design which requires replacing the high-temperature and highly stressed parts after each operation.

By adopting this concept of designing for minutes instead of designing for thousands of hours as in the case of gas turbines, the material will be stressed for ultimate strength and not for creep. This difference is illustrated

in *fig. 1*, where the stresses are plotted against temperature. The lower curves are design curves for creep, and the upper curves are the ultimate stress, a stress which is practically independent of the rate of strain.

For long operating time, the ultimate stress is not a design criterion, as the rate of strain near this stress is so large that the limiting strain will be reached long before the intended lifetime of the part, and the part will then fail. If the part is designed to have a life of only a few minutes, it can be stressed six times higher. This is a tremendous possibility in design and occurs only in rocket- and jet-propulsion engineering.

To explore this advantage leads, however, to complex problems in the stress and deflection analysis. The high rate of strain means constantly changing dimensions of the part, and its influence must be determined. The

* Condensed from a paper presented during the combined annual conventions of the American Rocket Society and the American Society of Mechanical Engineers, Dec. 1, 1949, in New York.

problem is not that of plasticity where the stress-strain relation is non-linear, nor that of elasticity, because now the material flows. In other words, the material must be considered as a visco-elastic medium.

As a first approximation, the stress-strain relation can be still considered as linear. To be specific, let $\sigma_x, \sigma_y, \sigma_z, \tau_{xy}, \tau_{yz}, \tau_{zx}$ be the six stress components, $\epsilon_x, \epsilon_y, \epsilon_z, \gamma_{xy}, \gamma_{yz}, \gamma_{zx}$ be the six strain components. The stress-strain relation for isotropic, visco-elastic media can be written as

$$\begin{aligned} p\sigma_x &= \phi(\lambda e + 2\mu\epsilon_x) \\ p\sigma_y &= \phi(\lambda e + 2\mu\epsilon_y) \\ p\sigma_z &= \phi(\lambda e + 2\mu\epsilon_z) \\ p\tau_{xy} &= \phi\mu\gamma_{xy}, \quad p\tau_{yz} = \phi\mu\gamma_{yz}, \quad p\tau_{zx} = \phi\mu\gamma_{zx} \end{aligned}$$

where λ and μ are constants and $e = \epsilon_x + \epsilon_y + \epsilon_z$.

The operators p and ϕ are linear time operators defined as:

$$P = \frac{\partial^m}{\partial t^m} + a_{m-1} \frac{\partial^{m-1}}{\partial t^{m-1}} + \dots + a_0$$

$$\Phi = \frac{\partial^n}{\partial t^n} + b_{n-1} \frac{\partial^{n-1}}{\partial t^{n-1}} + \dots + b_0$$

The a 's and b 's define the property of the material. They could be functions of time, but not functions of the space variables. Thus, a material with changing properties, caused by the drift toward thermodynamic and chemical equilibrium, also can be represented by these operators.

Variable Stress

An analysis (Refs. 2 and 3) of the mechanics of such materials reveals that, if the load on the part is specified by a time factor $g(t)$, then the stress distribution at any instant can be calculated as if the material is purely elastic with the same instantaneous load. The deflection of the structure is, of course, different. But it is specified by a time factor $h(t)$ which is independent of the particular value and distribution of the load and is only dependent on $g(t)$ and is determined by

$$Qh(t) = pg(t)$$

The $h(t)$ is thus a "universal" function in the sense that it is related only to $g(t)$ and the properties of the material. The other characteristics of the problem do not enter into its determination. In particular, the function $h(t)$ may be measured directly, experimentally, on a pure tension bar with the tension varied with time according to $g(t)$. This is then a considerable simplification of the mechanics of visco-elastic media and a useful tool in the application of the idea of design for short-time flow of material.

The extreme intensity of reaction in

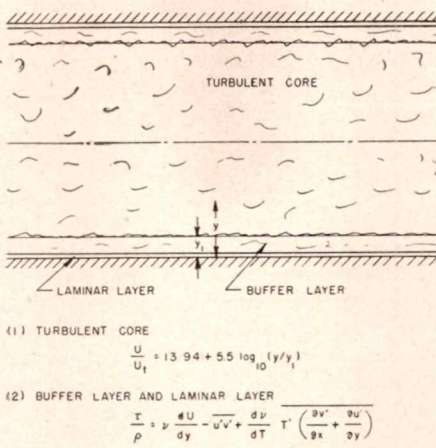


Figure 2

the rocket motor and in the combustion chambers of ramjets and pulse-jets, and the high velocity of gas flow, lead to a very high rate of heat transfer to the walls. For instance, at the throat of a rocket nozzle, heat flux as high as 6 Btu per sec per sq in has been observed. Changed into conventional units in other branches of engineering, this is more than 3 million Btu per hour per sq ft. To cope with

this high heat flux, designers have been forced to extrapolate the empirical laws of heat transfer to a cooling liquid and to seek other unconventional methods, such as surface-boiling heat transfer.

Heat Transfer

To absorb the high heat flux by circulating a cooling liquid in a duct surrounding the hot chamber, one must use large differences between the wall temperature of the cooling liquid under turbulent-flow conditions. Here the problem is the lack of proper understanding of the basic mechanism. At present, the designer relies on empirical rules which are only safe to use within the range of variables of the test result.

To extrapolate without the guidance of a sound understanding of the phenomena is satisfactory. Of course, the problem of turbulent heat transfer has been attacked successfully by O. Reynolds, L. Prandtl, G. I. Taylor, Th. von Karmen and others. But their work is based upon the assumption that the temperature difference between the wall and the bulk of the

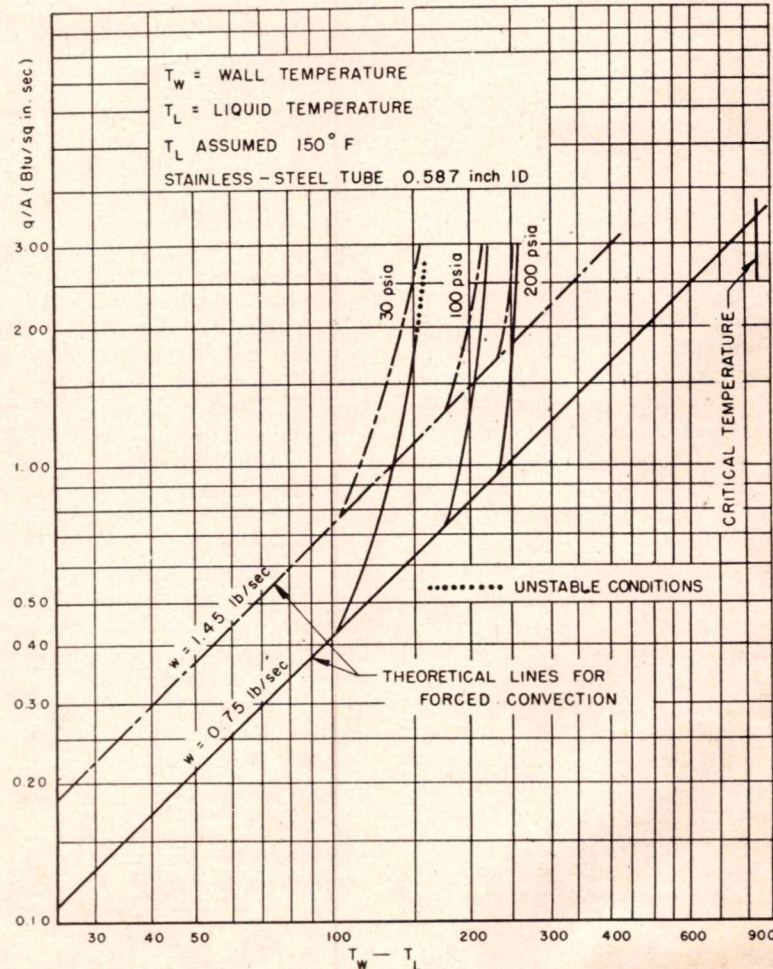


Figure 3

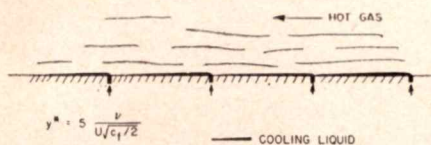


Figure 4

liquid is small, so that the flow is essentially isothermal.

Turbulent flow in a duct—say a circular pipe—can be divided into three regions (fig. 2): the turbulent central core where Reynolds' turbulent shearing stress dominates the molecular or viscous shearing stress, the laminar layer next to the wall where the viscous shearing stress dominates the turbulent shearing stress, and the buffer layer where both shearing stresses are important. For the turbulent central core, which occupies most of the pipe, previous experiments with isothermal flow indicate that the flow in general, and the velocity profile in particular, are controlled by the shear stress τ at the boundary of the turbulent core, the density ρ of the liquid and a linear dimension y_1 . Since the boundary of the turbulent core is very close to the wall, τ is practically equal to the wall shearing stress τ_0 . Together with ρ , τ_0 can define a velocity U_τ by

$$U_\tau^2 = \frac{\tau_0}{\rho}$$

Then, if U is the velocity at a point y from the wall, the non-dimensional equation for the velocity profile must be

$$\frac{U}{U_\tau} = f(y/y_1)$$

Clearly, the only available linear dimension for flow near the boundary of the turbulent core is the distance of this boundary from the wall. Hence, for flow near the boundary of the turbulent core, y_1 must be the thickness of the laminar and buffer layer. From previous experiments with isothermal flow in smooth pipes (Ref. 4), it is found that

$$\frac{U}{U_\tau} = 13.94 + 5.5 \log_{10} \frac{y}{y_1}$$

Since temperature differences in the liquid will change only the viscosity, and, according to experiments viscosity does not enter directly into the turbulent core flow, the velocity relation given above must hold also for non-isothermal flow.

The problem now is to determine the thickness y_1 . This thickness will vary with the temperature conditions. The work of H. Reichardt (Ref. 5) does not account for this variation and is therefore unsatisfactory. Thus, the main effect of higher temperature

differences is in the buffer and the laminar layers. Here the variation of viscosity with temperature changes the flow. For instance, the effective shear stress τ is given by

$$\tau = \nu \frac{dU}{dy} - \overline{u'v'} + \frac{d}{dT} T' \left(\frac{\partial v'}{\partial x} + \frac{\partial u'}{\partial y} \right)$$

where ν is the kinematic viscosity, T the temperature, $u'v'$ the instantaneous turbulent velocities in the directions parallel with the wall and normal to the wall, and T' is the temperature fluctuation. The bar over the second and third terms means averaging with respect to time.

The third term does not occur for isothermal flows. By its appearance in the equation for shear and the variable ν in the first term means now the effects of heat conduction, and the effects of shear are now coupled. The solution is thus more difficult than the corresponding isothermal problem, but the difficulty is believed to be surmountable.

When the wall temperature is raised beyond that of the boiling of the liquid under prevailing pressure in the pipe, local vaporization takes place and bubbles are formed over the surface. But, since the main bulk of the liquid is still at a temperature below the boiling point, these bubbles cannot grow indefinitely. In fact, experiments by F. Kreith and M. Summerfield show that they contract again and have a life span of about 1/100 second. During its short life span, the bubble does not seem to move appreciably from the wall. The main consequence of the bubble formation and disappearance is the strong agitation of the fluid near the wall.

It is then understandable that the heat flux can be increased to many times that of the case without local boiling. This fact is shown clearly in fig. 3, taken from the work of Kreith and Summerfield (Refs. 6 and 7). This means that a high rate of cooling can be achieved without high flow velocity in the cooling duct. The thus-reduced pressure drop in the cooling duct will decrease the necessary pumping work of the coolant. Boiling-heat transfer then can be used to good advantage for many designers. The problem for research here, of course, is a closer understanding of the turbulent

agitation due to bubble formation and thus better correlation of tests for different liquids and different test conditions.

If the wall temperature is increased beyond a critical value over the boiling point of the liquid, it has been found that a vapor envelope forms over the surface, and the heat flux is reduced by the insulating effect of the stagnant vapor. Therefore, with specified pressure and flow velocity, there is definitely a maximum value of heat-flux density even with local boiling at the surface. If still, high heat-flux density is desired, then other means of cooling have to be used.

Wall-Temperature Effects

However, even before reaching this intrinsic limit of boiling-heat transfer, the wall temperature at the inside surface of the rocket motor may be too high for the material strength, due to the necessary temperature gradient through the wall for the heat flux. For instance, if the heat flux is 6 Btu per sq in, the wall thickness is 1/16 in, and the temperature at the cool side of the wall is 600°F, the temperature at the hot side of the wall will be 1950°F if stainless steel is used. This temperature is certainly too high for good strength. New, powerful cooling methods for extremely high heat flux are sweat-cooling and film-cooling.

Film cooling (fig. 4) is achieved by establishing a thin liquid film in contact with the hot gas over the surface to be cooled. Due to the shearing stress acting over the liquid-gas interface, the liquid flows in the downstream direction. Simultaneously, the heating of the film by the hot gas evaporates the liquid. It is seen that, so long as there is a liquid film, the wall temperature is kept below the boiling point of the liquid.

It is noted also that, to protect the wall from the hot gas, liquid film has to be reestablished by injection through holes in the wall when the film upstream injection is evaporated. Of course, the intervals of injection can be lengthened by injecting more liquid and establishing a thicker film each time. However, the difficulty here is the instability of the film against the turbulent flow in the gaseous boundary layer. The resultant partial breakaway of the liquid in the form of droplets constitutes a loss in effective cooling liquid. The problem here is then the determination of the relative cooling efficiency with respect to film thickness.

From experience on one-phase turbulent boundary layer, it is found that the laminar sublayer thickness y^* is determined. (Continued on page 124)

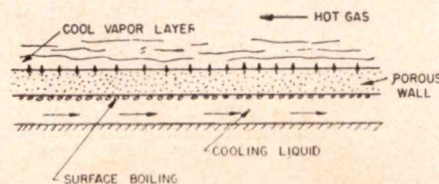


Figure 5

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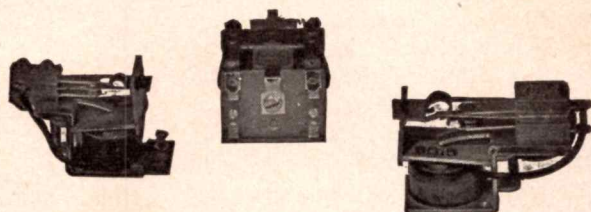
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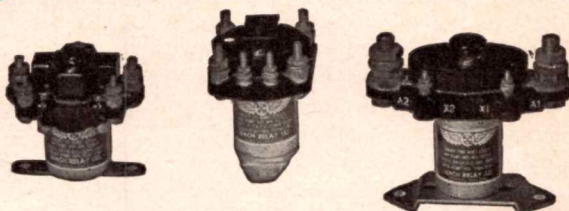
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$$y^* = 5 \frac{\nu}{U \sqrt{\frac{C_f}{2}}}$$

where ν is the kinematic viscosity of the fluid, U is the freestream velocity and C_f is the local friction coefficient. If this relation holds also for two-phase turbulent boundary layers such as exist in film cooling, y^* is the limiting film thickness for perfect efficiency. If the film thickness is larger than y^* , instability of the film and breakaway of droplets is likely to occur. It is then seen that there is an advantage in having a higher kinematic viscosity ν , as layer thickness is allowed.

If $U = 1000$ ft/sec, $C_f = 0.004$, and $\nu = 0.319 \times 10^{-5}$ ft/sec for water at 212°F , y^* is only 4.3×10^{-6} in. This result indicates that, for theoretical maximum cooling efficiency, the film should be very thin and reestablished frequently along the wall. The limiting case is sweat-cooling, where the coolant is forced through the porous wall and injection and evaporation occur at the same time.

Sweat-cooling is, however, not limited to the liquid coolant. The coolant may be gaseous. In fact, the most extensive experiments are made by P. Duwez and H. L. Wheeler (Ref. 8) with gaseous coolants. However, it is shown by the above investigators that the coolant cannot be allowed to evaporate in the porous wall, as then the flow is essentially not stable, with wide fluctuations in the wall temperatures.

Generally, then, the most efficient sweat-cooling system, with least expenditures of the coolant, is one that evaporates the liquid coolant on the "outside" surface of the porous wall before entering the porous material (fig. 5). In a sense, this system is a combination of boiling-heat transfer and sweat-cooling. No extensive experiment on this method of cooling has yet been made.

It is evident that, with either film-cooling or sweat-cooling, there is no limit to the temperature of the combustion gas that can be handled effectively. Therefore, one need have no misgivings about the high-energy fuels and propellants for cooling difficulties. Furthermore, for rocket, ramjet and pulsejet, there is no contact of the combustion gas with a delicate moving part, such as turbine blades in a turbojet; and the combustion gas can be corrosive and can contain finely divided solid particles. These factors remove practically all restriction on the choice of fuels and propellants. Such strange combinations as liquid hydrogen and liquid fluorine, and diborane

(B_2H_6) and air, are to be considered.

The more urgent problems of combustion in jet propulsion are those connected with fluid mechanical aspects. These are the auto-ignition of liquid jets, the evaporation of liquid droplets, the mixing of gaseous components, the mutual influence of combustion and turbulence of low combustion in the heterogeneous mixture etc. For ramjets, the most perplexing problem today is the problem of flame stabilization. This is a problem which confronts all ramjet designers. Worse still, the mechanism of flame stabilization is not yet understood. As a result, the flame-holder design for the combustion chamber is always done by *ad hoc* experimentation.

Clearly, there is a need for experiments with the simplest physical conditions, so that the parameters can be controlled. The work of A. S. Scurlock (Ref. 9) with homogeneous gas stream and controlled turbulence in the initial stream is the most noteworthy effort in this direction. However, for a true understanding of the mechanism, further detailed exploration of flow field is necessary.

It seems that one of the important aspects of flame stabilization is the interaction of the flame front and the boundary layer. To test this concept, a flame holder is the shape of a streamlined body may be tried (fig. 6). To start the combustion, the airfoil has to be heated first by, say, an electric current, to a high temperature. Once the flame is started, the airfoil aft of the flame is heated by the hot gas. Heat is then conducted through the body of the airfoil to the front section, where heat is given up to the cold gas mixture through the boundary layer. The cold gas mixture in the boundary layer being heated by the body will increase the concentration of active carriers and finally ignite at the intersection of the flame

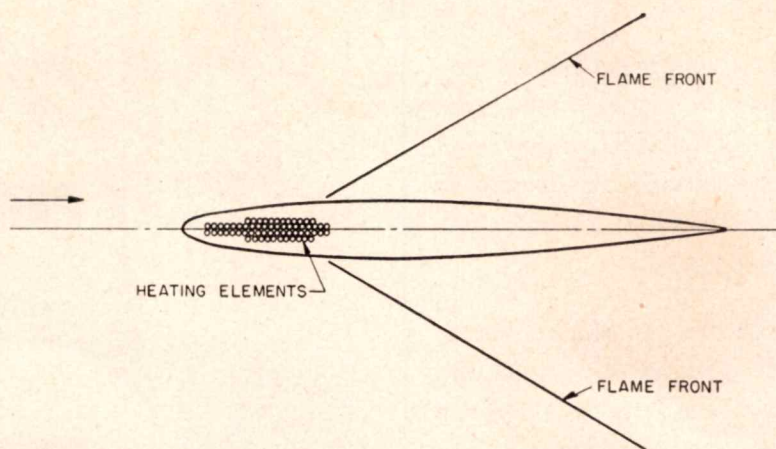


Figure 6

front and the surface of the body.

It is evident that such a flame holder without turbulent and eddying loss has many practical applications despite the difficulty in starting. In fact, by increasing the length of the airfoil in the hot gas, the temperature at the front part can be increased, and thus the gas velocity can be raised without blowouts.

The ultimate aim of all this basic research is, of course, to improve the performance of rocket and jet-propelled vehicles. However, even when given the best powerplant, the designer still has to determine the best way of using it for optimum performance of the completed vehicle. For instance, what would be the optimum thrust programming for a sound rocket? What would be the gain possible by varying the thrust during ascent? Is this gain justified by the additional complication in the design?

The basic variational problem of thrust programming was studied by G. Hamel (Ref. 10). However he made no detailed calculations to allow the designer to weigh the importance of different aspects of the problem.

Long-Range Trajectory

But the fundamental question in the performance analysis is the trajectory, particularly the long-range trajectory. Earlier in this discussion, the reason for favoring the dynamic trajectory of varying velocity was given. But what particular dynamic trajectory? To avoid the penalty of high drag at high velocity in the dense atmosphere and yet to be able to accelerate the vehicle quickly, it is clear that the vehicle should be launched vertically.

Performance of the vertical trajectory of a rocket is well-known. But is a rocket the only powerplant capable of vertical trajectory? Certainly the ramjet—once boosted to a suffi-

ciently high velocity—also can produce enough thrust to make an accelerated vertical flight. A ramjet would weigh more than a rocket per lb of thrust produced, but the fuel consumption is very much smaller. Preliminary estimates by Z. H. Schindel (*Ref. 11*) show that the advantage of low fuel consumption overcomes the disadvantage of heavier dry weight. Therefore, there is a definite gain in substituting the lowest stage of a multi-stage rocket with a ramjet. Of course, to boost the ramjet to operating speed, it has to be operated as a ducted rocket in the first few seconds.

What can one say about the remainder of the trajectory? Since the high velocity of the vehicle is reached outside the atmosphere by vertical or near vertical ascent, the first part of the trajectory has to be liftless and this is elliptical. When the vehicle returns to the atmosphere at practically the same speed as it leaves the atmosphere, the lift of the body of the vehicle can be produced by putting the body into an angle of attack. The question here then is one of programming the angle of attack of the body so that the maximum range is obtained.

As an example of such a dynamic trajectory, the flight of a 3000-mile rocket vehicle is studied under the assumption of steady glide after the initial elliptical path. The average lift-drag ratio in glide is taken to be 4. The result of this analysis is as follows:

Length	78.9 ft
Maximum diameter of body	8.86 ft
Gross weight	96,500 lbs
Fuel load	72,400 lbs
Weight after "Brennschluss"	24,100 lbs
Propellant loading fraction	0.750
Exhaust velocity	12,000 ft/sec.
Propellant	liquid O ₂ liquid H ₂ ; liquid F ₂ liquid H ₂
Maximum velocity	9140 mph
Range at conclusion of elliptic path	1200 miles
Range contributed by glide	1800 miles
Altitude at beginning of glide	27 miles
Landing speed	150 mph
Landing angle	20°
Flight duration	Less than one hour

Thus it is seen that the requirements of a transcontinental rocket-liner are not at all beyond the grasp of present-day technology. The wings need not be large to achieve a reasonable landing speed, and the specifications on the structural weights are not impossible. When will such a rocket-liner be realized? That is a difficult question. But one thing is certain; the basic research as outlined in this discussion definitely will hasten the day of long-range rocket travel.

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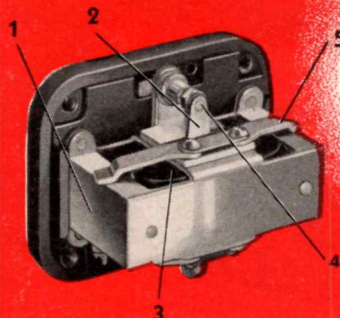
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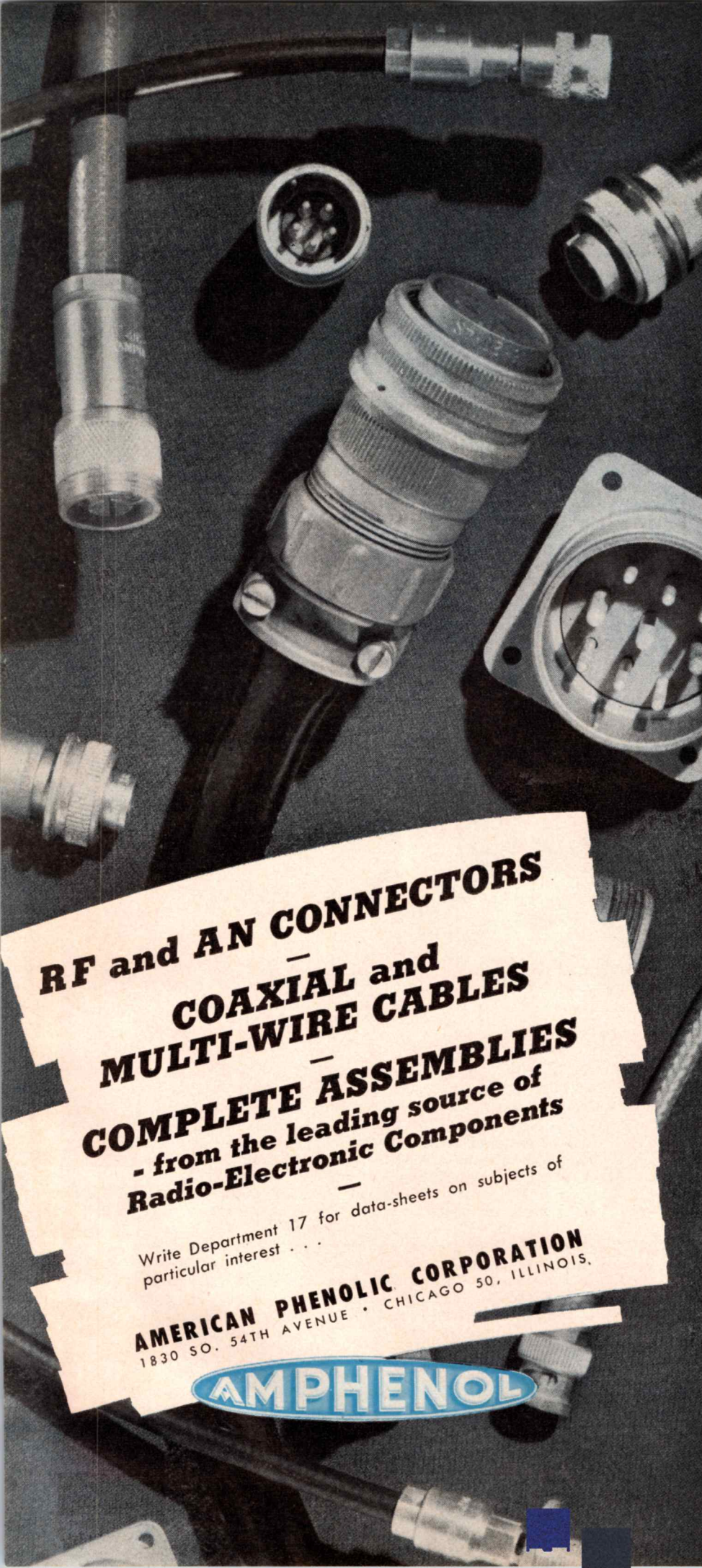
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AMPHENOL

Seeks Aviation Lore

Dan G. Hoffman, lecturer in English, Rutgers University, and member of the American Folklore Society, is compiling a collection of the lore of aviation. He hopes to obtain a representative selection of the superstitions, odd beliefs, jinxes, jokes, tall stories, special nomenclatures, drinking toasts, songs and customs which have characterized aviation from its beginnings.

Mr. Hoffman would appreciate hearing from Early Birds, military airmen of both wars, civilian pilots, engineers, airport operators, and others interested in aviation who might have something to contribute to this collection.

AT PRINCETON

(Continued from page 51)

been used as fuels.

This ducted powerplant—a combination of a rocket motor and a ramjet—is seen as having possibilities of good thrust characteristics at low speeds (unlike a pure rocket or ramjet), wide operational limits in speed and altitude, simplicity and flexibility.

Another interesting project is an experimental, intermittent ramjet. Fuel is introduced cyclically and combustion is intermittent (explosion type). Since the power output of reaction engines depends upon the operating-pressure level, the intermittent ramjet is superior theoretically, as there is a pressure rise during each cycle. An investigation is being made to determine the theoretical superiority that can be attained.

These experiments are a part of the Navy's Project SQUID, established at Princeton in 1946 for the purpose of planning a coordinated program of fundamental research on scientific topics related to advanced and new types of rocket and jet engines.

Headquarters are located at Princeton. Activities include more than 50 separate research investigations being conducted at seven eastern universities. More than 150 university scientists are engaged in the program.

Princeton also is putting into operation its variable-density "blow-down" supersonic wind tunnel, which is capable of simulating airflow conditions over airborne surfaces at speeds from 1000 to 3500 mph and at altitudes from sea level to 20 miles or more. Its range of conditions is said to exceed that of any known supersonic tunnel.

The tunnel's unusual flexibility is due to (1) an air supply stored at 3500 psi in 47 cylinders with a total capacity of 1000 cu ft (the equivalent of 240,000 cu ft of unpressurized air); and (2) an 8-in hydraulic regulator valve connecting the battery of air

containers with the test section.

The valve holds the pressure in the tunnel settling chamber within 1% of any desired value from 30 *psi* to 900 *psi* during a run. Operating periods can be ranged from one minute to approximately 15 *min.* Two 100-hp compressors charge the air-storage cylinders to full pressure in approximately eight hours. This stored energy can be released at the rate of 50,000 *hp* when desired. The arrangement provides for a high-capacity tunnel which is operated with a low-cost power supply.

ALLISON

(Continued from page 51)

the best weight-power ratio in the world. It is matched only by the Allison T40 turboprop, which consists of two T38 power section coupled through a common reduction gear, and weighing only 2500 *lbs* (gear and shafting included) and producing 5500 *hp*. Both of these powerplants were developed under U. S. Navy sponsorship.

Four of the T40 engines are installed in the Consolidated XP5Y-1 flying boat expected to be flown soon. Thus, Convair again comes into the limelight. Back in 1945, its XP-81 fighter, powered by a General Electric TG-100 turboprop in the nose and an I-40 turbojet in the aft fuselage, was the first aircraft to employ a gas turbine to drive a propeller.

That year, the *Convair-Liner* was in the initial design stage and its engineers decided to provide for an eventual modification to turboprop engines. Accordingly, it has the structural strength for a substantially higher cruising speed than its reciprocating engines provide. The *Turboliner* also presents the possibility of earning higher profits, due to a weight saving of approximately 2000 *lbs* with the turboprop installation.

General Motors takes another "first" in that the propellers for the plane are being provided by its Aeroproducts Division. The design used is similar to turbo-propeller models developed for BuAer for the past five years. Aeroproducts also supplied the propeller for the Convair XP-81 experimental fighter and is furnishing the contra-rotating props for the Consolidated Vultee XP5Y-1 high-speed flying boat.

Allison broke the ice. There has been much talk about the need for Government backing to produce a jet-transport prototype. Allison struck out on its own in the turboprop (perhaps interim) field. Federal assistance seems more remote than ever, and it doubtless remains for another manu-

facturer (or combination) to put out a turbojet-powered transport prototype and subject it to the same kind of

practical operational testing.

The *Convair-Turboliner* is scheduled to fly some time in June.

CHRISLEA "SKYJEEP"

(Continued from page 24)

In addition to its convertibility into a light cargo and ambulance plane, the design is suitable also for aerial survey work, as an agricultural aircraft and as a feeder mail transport. The ship is completely wired for VHF-radio installation and has been subjected to anti-corrosion treatment.

Donald Lowry, Chrislea's chief test pilot and sales manager, has stated that the *Sky-*

jeep is capable of performing a comprehensive range of duties with efficiency and economy. Its performance is designed to cover all conditions, from the sustained, ultra-slow flight of the crop-duster to the useful cruising speed at full load required by the charter operator.

The remarkable take-off-and-landing performance overcomes all problems of limited

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takeoff run, bad surfaces and obstructions. On its initial test flight, it took off—fully loaded—in just under 450 ft. followed by a steep climb of 650 fpm. Specialized detail and built-in "get-at-ability," seem to have produced a trouble-free combination which should pay dividends to any operator.

KLEMIN HONORED

(Continued from page 38)

helicopter three-seater costs \$19,500. Spare parts come high, and maintenance has to be thorough. The American public's idea of maintenance for any mechanical gadget is that none should be needed. But even these difficulties of cost and maintenance will disappear gradually as young men get to work on helicopters for private flying, particularly young men who receive no financial support from the Government."

Dr. Dryden, discussing research in aerodynamics, stated: "We may expect a succession of further penetrations into the supersonic speed regimes with each passing month. These flights represent great achievement and reflect enormous credit on all involved—the military, the manufacturers, and the scientists. To the designer of operational-type aircraft, however, they simply represent goals—somewhat distant ones at that—depending upon the rapidity with which he can secure detailed design information.

"It is not simple, but certainly it is relatively simple to contrive a machine merely to go fast. But practical operational speed is the most important attribute of an airplane. What makes the airplane-design game worthwhile are the beautifully balanced compromises that give the craft an ability to take off and land safely, to have a useful range, to carry a useful load, to operate at desired altitudes, to maneuver for its intended purposes, to withstand the air loads imposed upon it—in short, to do everything we want it to do as well as to go fast.

"It is in this area of necessary design compromise that research that yields design information pays off. It is an unglamorous, time-consuming, and costly type of research. In the high-speed classification it is many times more costly than in that of subsonic speed. Moreover, as the designer is in competition for military contracts, his understandable pressing for new data knocks the traditional atmosphere of leisurely contemplation of the scientists into a cocked hat. Ulcers are as common in the modern aeronautical-research business as in the advertising business.

"Difficulties with high speeds require early solutions. The swept wing, which delays the onset of compressibility, offers a large share of the solution. Just coming into operation are large-scale wind tunnels capable of speeds up to a Mach 2. Small tunnels, with speeds ranging up to Mach 10, are cropping up here and there as the fundamental scientists push ever forward in laying the groundwork for still higher speeds for experimental aircraft and missiles. Where does this thing end? This question has been asked repeatedly for many years. If we were to rest content with any given achievement of speed, we would thereby concede to some other more realistic and

forward-looking nation the control of the air that is essential to our national security.

"In going from subsonic to supersonic flight, the aerodynamic-research picture is immensely complicated by the changes in the behavior of the medium. The condition of mixed flow in the transonic range poses unsolved problems of mathematics to establish a reliable theory. As yet, we have in operation no wind tunnels which are capable of supplying reliable experimental data in the transonic category.

"One of the important research goals is the conversion of research-airplane speed achievements to everyday performance for operational-type aircraft. The problems involved challenge the best trained minds of our day. The stakes are high not only for the individual aircraft designer; they are high for all of us, for, in continued success in this field at the hands of free men, lies, partly, at least, our hope of peace."

FLYING SAUCER

(Continued from page 32)

understood by helicopter designers. To the contrary, in beams or rays, a small mass is given a very high velocity; and, consequently, enormous power—greater than the total world's capacity—would be needed to support even the smallest object by such means."

From another sage we have this thought: Whenever a man undertakes the study of any technical or scientific problem, some supernatural agency seems to come into play, bringing him, almost without seeking, information allied to his field of study.

Thus, because this writer was thinking of flying saucers, Dr. E. W. Kay sent in particulars of experiments on flying disks. A diversion from our main argument is permissible to discuss the model aircraft shown in the two photographs.

Dr. Kay's model has been tested on a static-thrust stand, and on a whirling arm for forward-flight conditions. His own description reads:

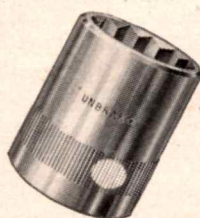
"The model is of aluminum and magnesium-alloy construction and is equipped with a fuselage (powerplant), propeller (horizontal thrust), fin (spin prevention) and devices for automatic control of vertical lift by centrifugal and spring forces. The connection between the stationary and whirling surfaces is made by ball-bearing arrangement and a gear transmission.

"In the tests, it was found that, at about 25° pitch of the blades, the craft obtained the best direct lift (3-1/3 lbs for 1/3 hp) at approximately 500 rpm, when tested on the static-thrust stand. But in flight (or rather when tested on the whirling arm) the best lift was at about 18° pitch for the blades. The most difficult part of the tests in flight was determination of the cg for stability. Of course, it was impossible to prove by testing the model whether a flying disk aircraft can be safe for transportation, except for some promising indications. The advantages of such an aircraft would be in higher

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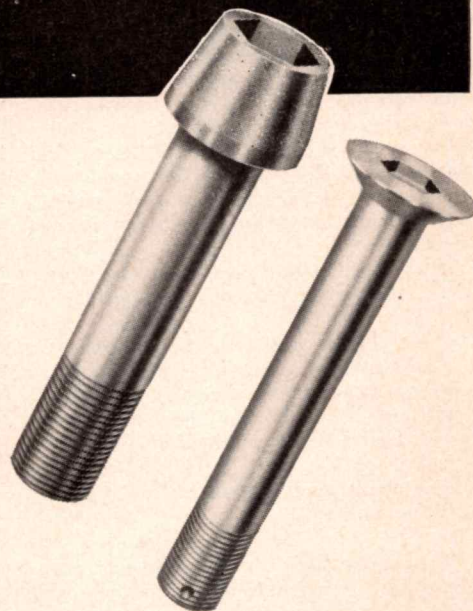
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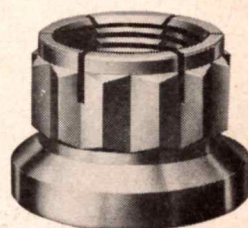
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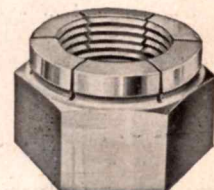
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horizontal speed in comparison with the helicopter. It is possible also to expect increased stability from the gyroscopic effect of the whirling disc.

Here the obvious criticisms: The direct lift of 10 lb/hp on a small model is woefully small. It can be shown by elementary dimensional considerations that a small model should have a much greater thrust/hp than a fullscale model. The inefficiency in lift might be expected because the whirling disk eats up power in skin friction, unnecessarily. In forward flight, the gyroscopic effect would be a nuisance; the skin friction losses of the whirling disk would continue—there is no provision for counteracting the greater lift of the advancing blades.

Then, wherein lies the interest of the device? As we see it in this one derivative:

The blades open and act by some combination of centrifugal force and spring action. Why shouldn't they lift the aircraft? And why shouldn't disk and blades cease whirling afterwards, and the blades then lie hidden in the disk which would become a fixed wing lifting surface?

This seems like another embryonic suggestion for convertible aircraft which we place freely at the disposal of Dr. Kay—and of the world at large!

Are we worried by threats of war and hydrogen bombs? There is temporary relief and amusement in reading the Wright Field Report of Project Saucer:

(1) An Oklahoma City man reported that he saw a flying saucer seeming to be the bulk of six B-29's. He said at first it looked like a big white plane, but moving closer it began to look round and flat with no protrusions. He heard no sound and reported the speed as probably three times that of a jet.

(2) Two children playing in their back yard one afternoon last August in Minnesota reported seeing a strange object about 12 ft off the ground descending between them: "It hit the ground, spun around once, made a whistling noise and then shot straight up into the sky about 20 ft, stopped again and made more whistling noises," the children told their parents. The object then shot up about 10 ft more, maneuvering around tree branches and suddenly sped off to the northwest. The children said the disc was about two ft in diameter and of a dull gray color. Soil analysis of a recession in the earth, where the children claimed the disk had landed, proved negative.

But why go further? All the stories are about on the same level.

The air is well populated with rockets, plastic balloons that become translucent at altitude, Venus in the sky at times. Hoaxes are tempting. There are reflections from the stars and from ground beacons, in the clouds. And here is how a *Saturday Evening Post* story defines saucer chasing by pilots: "Wright Field aero-medical experts . . . feel that when a flyer starts chasing an illuminated weather balloon or a star, and

vertigo and hypnosis set in, the pilot can come down and practically tell you how many rivets were on the nose of that Martian space ship."

There is nothing in "flying saucer stories"

aerodynamically, nothing in them electromagnetically, nothing in them psychologically. However, they should add to the gaiety of nations and replace the sea serpent when the city desk has little news.

THE OUTLOOK

(Continued from page 45)

this provides a good market for our own products which are designed to fit their specific requirements. We look forward to a continuation of good business in the Air Associates factory.

Deflation of the short post-war boom in pilot training and private flying left many small airports and operators without much business. The survivors are working on a firmer foundation and 1950 probably will show greater stability in the private-flying field, at a level well above pre-war.

Sound growth of single-engine public carriers, industrial aircraft usage

and the new star mail routes also will promote stability in small-aircraft operations. These improvements, plus continuing good business with airlines and airframe manufacturers, seems to indicate an improving market for well-established distributors of supplies and materials now that the glut of war-surplus material is fading.

Exports of American aviation products have been reduced drastically as a result of currency devaluations and there seems to be little prospect of any major improvement as long as present unbalanced world conditions exist.

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DONALD W. DOUGLAS

President, Douglas Aircraft Co., Inc.

THIS year, the Douglas Aircraft Company celebrates the 30th anniversary of its founding. From the perspective of those three decades, I can say with assurance that the airplane's commercial utility and its ability to serve people have been thoroughly demonstrated. With equal

confidence, it can be stated that, unless civilization meanwhile destroys itself, aviation's opportunity for service to mankind in the future is unlimited. I have unbounded faith in aviation and the industry's ability to meet or surpass any challenge from any source.

"Aircraft design should allow for controls"

ALFRED M. WILSON

Vice-President, Minneapolis-Honeywell Regulator Co.

AIRPLANE builders have demonstrated planes that will meet the requirements of speed, altitude and range essential to modern military needs. Engine manufacturers have powerplants to go with these planes. It remains now for the electronic-control makers to demonstrate that they can meet the requirements of control and guidance. Through the great advances in radar, omnirange, distance-measuring equipment and computers, the elements are available as far as usable information is concerned. Yet it is fair to say that the design of electronic-control equipment for use in planes has lagged technically behind airplane and engine design.

The fact that electronic-control design has followed plane design has been partly a result of a custom in the aircraft industry. It has been usual, after the frames of aircraft have been well along in final design, to call at that point for the addition of elaborate

control systems. Today it is realized that, for an efficient design, the airframe, computers and control systems must be custom-tailored to each other. The design of each must be started at the same time and proceed together. This should result in an improved over-all product.

In bombers, the greater range, speed and altitude needed are already demanding refinements in automatic pilots and in the navigation and bombing fire-control information fed to them; refinements which must be met if missions are to be carried out effectively. The defense needs of the country are focusing attention on the requirement for faster high-altitude interceptors, capable of quickly digesting and putting to use all kinds of control information to make a kill certain. The pilot must be aided by better servomechanisms to allow him time to do what only he can do—think. Moreover, bombers, interceptors and ground

defense will use missiles which, in most cases, require guidance after launching.

For these reasons, electronic controls will receive great emphasis in the future as an integral part of aircraft and guided missiles. Without controls capable of utilizing to the maximum the full potentials of technical advances, we cannot expect to maintain the lead we must have in aeronautical effectiveness. The new procedure of developing and designing airframes and controls simultaneously will speed the performance necessary if the country is to be secure.

SURVIVAL IN WAR III

(Continued from page 20)

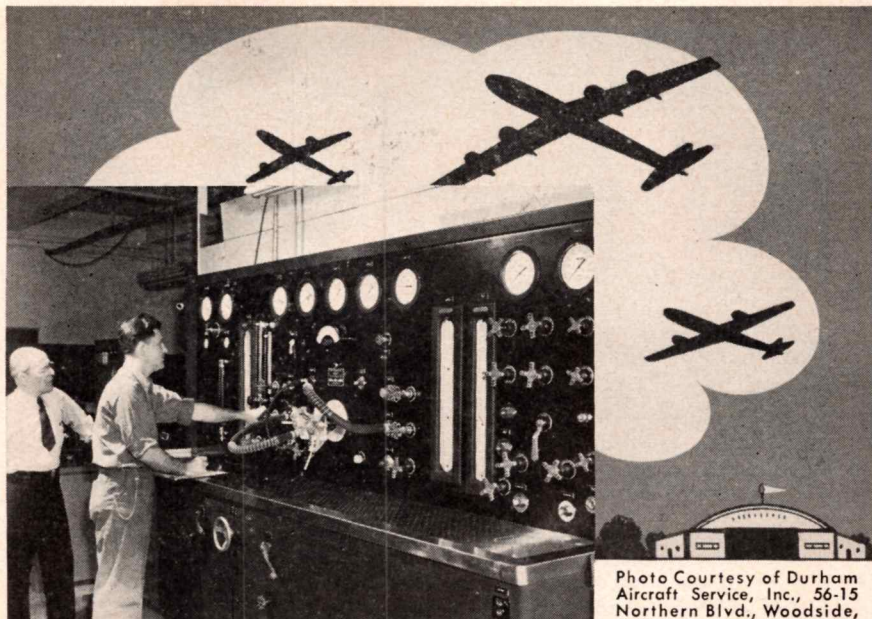
were on the surface at the time, not submerged, so that was still a submarine attack on a surfaced ship. Under-water battles between opposing forces that stay submerged appear to be in the offing. If we are anywhere near equality in this form of combat, U.S. surface anti-submarine forces will provide an added advantage.

Most people probably think of atomic warfare in terms of long-range bombers dropping destruction on cities. This is limited thinking. Also, there should be no excuse for Russian bombers arriving here undetected.

If the U.S. radar network is functioning properly, there should be no such thing as a surprise bombing attack. We should have had warning almost from the moment the Russian bombers left their own land—from our submarine radar pickets off Russian Atlantic and Pacific coasts, from radar stations in the Arctic, in Greenland, in Alaska and from naval ships at sea. (There is comfort in speculating that the American submarine *Cochino* that sank off the coast of Norway some time ago as the result of a battery explosion—it was said—may have been in the area for some purpose other than cod-fishing.)

However, there is the possibility that large numbers of enemy submarines might take up positions around U.S. coasts, with no more than a very few of them discovered by under-water listening devices or by visual observation from ships or aircraft. If they travel submerged, with no more than their schnorkel tubes above water, there is only a tiny object to see; and if they travel at depth on batteries, they can be found only by sonar. Of course, we should know the moment that numbers of them depart from their bases. With large numbers, surely some will be detected. In fact, it seems impossible that any large-scale attack, from the air or from the sea, ever will effect complete surprise.

It seems a reasonable assumption that a seaborne atomic attack would be accompanied by one that is airborne, so that cities of the interior would receive a blasting at the same time that coastal areas were being attacked. It is not beyond the bounds of possibility that the Russians may be counting on this one tremendous initial blow from the sea and the air to paralyze the nation to such an extent that recovery and



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J. E. Rheim, vice-president, left, and Fred H. Rohr, president and general manager of Rohr Aircraft Corp., look on as C. Russell Feldman, president of Newport Steel Corp., signs papers returning Rohr Aircraft to the ownership of Rohr and his associates. Company is best known for its power-package assemblies

continuation of the war may seem an impossible task to the average citizen. If fifty million terrified citizens believe that continuing the war can result only in the destruction of the nation, how can a democratic government, and a better informed military command, make the citizens believe otherwise?

The word SURVIVAL is used in the title of this article in the firm belief that the threatened war between the dictatorships and the democracies would be an all-out war for survival, not only as nations, but for individuals in numbers mounting into the hundreds of millions.

There appears to be a chance that the horrible destruction wreaked by each contender upon the homeland of the other in the initial attacks may be of such appalling extent that a compromise peace, without a decision, might be possible. But that probably only would postpone an eventual decision.

Our scientists, our engineers, our political and our military commanders should, I believe, inform our people and people all over the world of the dangers that confront humanity, from those in the greatest nations to those in the smallest; from the residents of great cities to dwellers in the countryside, and in remote places, all over the globe. We must recognize that there can be no safety anywhere—unless there is safety everywhere—or hatred and suspicion everywhere. The world today has no safety zones. And the traffic of destruction is waiting only for the green light.

These comments have been restricted purposely to a possible Russian attack upon the U. S., ignoring the fact that we supposedly have allies in Europe and throughout the British Empire. Russian propaganda attacks in the present so-called cold war have been directed almost solely against the U. S. We are the enemy; the Russians leave the world in no doubt about that.

Suppose the Russians accompany an attack upon us with the announcement that they plan no military action against any other nation—especially Great Britain, every one of whose cities could be blasted by atomic rockets launched from the seas

around the British Isles. In that event, would the British leap to our help when they might expect immediate retaliation? They might be well aware that a Russian victory could result only in their own domination, at least politically, by Russia. But it is not inconceivable that they would accept this, rather than the prospect of annihilation.

In our present thinking, we should include the possibility that, in a war against Russia, we may stand alone.

OUTLOOK BETTER FOR AIR POWER

(Continued from page 22)

In this mid-term election year, there are yet no party issues in aviation as was the case in 1948. No one wants politics in aviation. But maybe aviation will have to get into politics.

A danger foreseen here is that the H-bomb, and other new weapons blueprinted but not yet ready, will cause neglect of today's equipment, soon to become obsolete. Until tomorrow's weapons are here, the balance against war or against defeat is in what's ready now, while blueprints known to the Reds may hasten their plans to use what advantage they have.

Recognition of the importance of futuristic weapons may be seen in the recent Air Force creation of a Research and Development Command, co-equal with SAC, AMC and ConAC; also a headquarters staff section and a Deputy Chief of Staff on this important subject.

But at any given time, air power-in-being is all that counts.

Viewing the continued advance of British and Canadian jet transports, the airlines and industry (or at least most of the industry) have been increasingly eager for a bill to subsidize the development of American prototypes. But the on-again plan is off again.

After a long wait for the Department of Defense to clarify its position, the Senate Interstate Commerce Committee reopened its airline hearings when witnesses said they were ready. It was stated that the Air

Force filed a plan for developing two planes — a military model adaptable to commercial use and a commercial type adaptable to military.

But the Budget Bureau ruled that a commercial aircraft was not within the Truman program. That left all concerned in confusion. To push for an authorization bill through the Armed Services Committees against the negative report dictated to the military did not look promising.

The alternative could be to seek a similar bill for CAA supervision via the Interstate Commerce Committees, where airline influence is strong. Even so, the Budget Bureau attitude remains. Boeing would prefer CAA control. Some others are dubious, on the grounds of CAA inexperience in development work and limited fund appeal in Congress as compared with that of the Armed Services.

While legislation has been pending, there has been a natural reluctance of the industry to develop jet transports on its own. If the sessions ends in turn-down, the airlines may want the manufacturers to re-examine the possibility of developing on their own.

Could a manufacturer of a jet bomber make his own transport version? Or could a plane maker produce a transport prototype and seek orders for a bomber version? For CAA to do the flight testing, which runs 25% to 40 % of prototype cost, is a possible compromise.

If there were such a thing as a firm air-

New Extrusion Plant

SOUTHERN EXTRUSIONS, INC., recently acquired 45,000 sq ft of manufacturing space in Magnolia, Arkansas, and was in production 75 days later. In that short time, approximately 75% of the equipment was designed and built on the site.

The three owners, R. W. Sullivan, H. N. Sebring and J. A. Ida, claim to have a combined experience in the aluminum-extrusion field totaling 40 years.

Improved methods in this plant are said to cut scrap losses to a new low. The first equipment in production is designed for lightweight extrusions requiring a high-grade finish. This will be followed by a larger press and heat-treating facilities.

AIR EVENTS

(Continued from page 75)

June

- 2-11—7th Annual Michigan Aviation Week. Sponsored by the Aero Club of Michigan
- 4-9—Society of Automotive Engineers Summer Meeting. French Lick Springs Hotel, French Lick, Ind.
- 10-13—National Aeronautic Assn. Convention. Hotel Statler, St. Louis, Mo.
- 21-25—Ninety-Nines Convention. Fort Clark Guest Ranch, Brackettville, Tex.
- 26-30—American Society for Testing Materials. 9th Exhibit of Testing Apparatus and Related Equipment. Chalfonte-Haddon Hall, Atlantic City N. J.

line order, industry might proceed without Federal commitments. But the pre-war experience, when the lines withdrew from the original DC-4, and the 1947 cancellations, make the risk seem doubtful. Progress is likely to lag pending the authorization and appropriation of Federal funds, unless some airtight escrow deal with the airlines is consummated. Meanwhile, the turboprop gives promise as a transitional device. Allison bought a *Convair-Liner* to test its newest engine.

New interest, both in the Senate and House, is directed toward a separate bill for a relatively inexpensive lightplane prototype. The grim fact of 5000 killed in non-air-carrier flying since the war—also a continuing toll of 100 per month and scores maimed—is pressed by airline pilots as part of their demand for an independent safety board.

The losses to aviation through resultant fear psychology, and the ever-present hazard of airline collisions, could be abated progressively by a model capable of landing in a short space so that entry into terminal airports no longer would be necessary. While the cross-wind gear takes one dimension from an airport, plane models easily within reach can reduce the other dimension.

The cost of just a few multi-direction fields, such as CAA has financed since the war for private flying, easily could cover the modest expenses of a prototype which might well revolutionize private flying and rescue hundreds of operators.

The Personal Aircraft Council issued a 16-page pamphlet entitled "Plane Utility" showing how present models can be used in business and agriculture. PAC looks toward a gradual evolution when enough airfields are built.

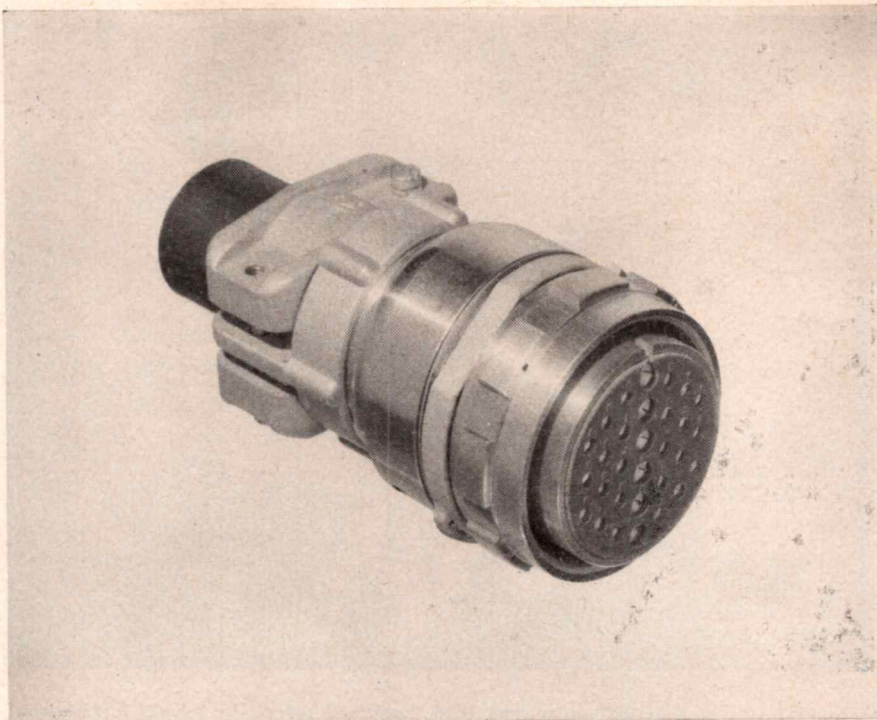
The National Association of State Aviation Officials and many other authorities are increasingly insistent, however, that a vehicle to do away with airports, rather than pouring money into idle fields, is the key to solution of the problem. Meanwhile, NASAO favors the installation of stall-warning devices on all civil aircraft. Since spin/stall accidents are more than half, this is deemed essential, as present-type planes will continue to dominate private-flying operations for some years yet.

These and other points are being placed on record in House Interstate Commerce Committee hearings on the bill for an independent safety board. Though airline and official witnesses gave much evidence of progress in safe airline navigation, pilots and veterans see room for improvement in measures to save lives when accidents occur. Better ground equipment and training for rescue and fire-fighting are among the points.

Little else has been moving. The Air Force Academy bill, upon which House hearings are expected, is held unlikely to pass this year. Site applications have been received from 195 cities and in 34 states. Congressmen are reluctant to expose themselves to pressure from local chambers in the election year.

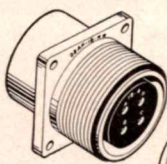
The Air Force composition bill, which passed both Houses last year with conflicting language as to prototype aircraft, still has not been adjusted in conference.

Airport bills, pushed by NASAO, include S 1281, to increase the federal share of airport land cost from 25% to 50%, and S



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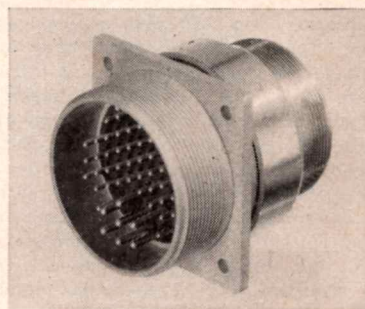
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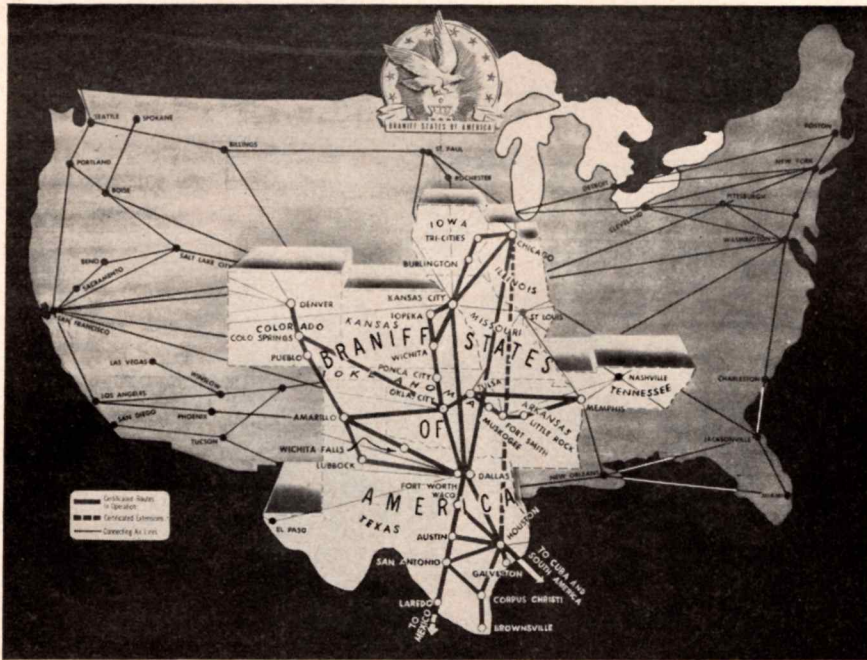
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1283 for fields in national parks.

The Taft-Teague GI-training bill (S 2596), approved by Senate last year, was given Rules Committee clearance for House action. VA is making a last-ditch fight as we go to press.

Meanwhile, Federal contracts from past years' appropriations are at a record high. To eliminate the need for "5 per centers," the Defense Department is about to announce a new plan for making information regarding bid invitations more widespread, that interested companies in all areas may compete.

TURBINE AUXILIARIES

(Continued from page 31)

has not gotten beyond the development stage with its Model 502 auxiliary gas turbine. Several models have been built and it appears now that it may be in its final modification form. The outstanding feature of the 502-1-1 is that it consists of two distinct parts—a gas-producing section embodying a single-stage centrifugal compressor, two combustion chambers, and a single-stage turbine driving the compressor; also a power-output section incorporating a single-stage turbine, a reduction gear, and an output driveshaft. There is no mechanical connection between the two turbine sections except the shroud and the engine frame. This arrangement permits the gas-producer speed to be controlled independently of the output shaft speed, resulting in an engine with an infinitely-variable power transmission.

The construction of this gas turbine follows accepted practice. The air intake is in the nose of the compressor which has diffuser vanes and two tangential outlets. The combustion chambers have integral vane diffuser elbows, with a fuel injector mounted

in each elbow. The single-sided impeller and the first-stage turbine disk are mounted on the same shaft which runs in two anti-friction bearings. The second-stage turbine disk, of larger diameter than the first-stage one, has an integral stub shaft running in one anti-friction bearing and connected by planetary spur-type reduction gears with the power-output shaft. The exhaust is discharged through a bifurcated manifold.

A single gear-type, high-pressure fuel pump of Boeing design, operating at a pressure of 400 psi. and a Boeing overspeed governor are standard equipment. A Pesco fuel pump with a Woodward overspeed governor is optional. Lubrication is on the dry-sump principle, with a normal pressure of 50 psi. An EEMCO 1½-hp electric starter is fitted. The engine is rated at 160 shaft hp at 36,000 rpm at sea level, and weighs 185 lbs. The Navy is sponsoring this development.

The only competition facing American auxiliary gas-turbine powerplants at the present time comes—not from England where the gas turbine has reached a very high state of development—but from France, where considerable difficulties were encountered in getting their engine industry functioning again after the war. There, the Société Anonyme Turbomeca, well-known for its research work on turbo-superchargers for the past 10 years, developed a series of small gas turbine powerplants some of which are for jet-propulsive purposes while others are for driving auxiliaries such as electric generators, pumps, and aircraft accessories. The most advanced of these auxiliary-power units is the Model TT-782, designed under the supervision of M. Szydlowski, president of the firm, who holds many patents in the high-speed engine field.

The Turbomeca TT-782 is conventional in most respects, having a centrifugal-type compressor with a single-stage impeller, an an-

nular combustion chamber with an annular flame tube, and a two-stage turbine with both stages coupled directly with the compressor, and the main driveshaft. The outstanding feature of this new powerplant is its novel system of fuel injection, which utilizes a ducted-disk mounted on the shaft connecting the compressor and the turbine, with the fuel sprayed by centrifugal force through small holes in the periphery of the disk into the combustion chamber. The amount of fuel injected is controlled by a throttle valve and an automatic speed regulator of Turbomeca design, with a by-pass which regulates the fuel pressure for slow running and idling. The fuel pump, operating at 60 psi, and the electric starter are mounted on the gearbox which forms an integral part of the compressor casing.

This power unit includes an Alsthom electric alternator of 35-kw capacity at 6000 rpm, mounted at the front end of the compressor. The rated output of the gas turbine is 140 shaft hp at 35,000 rpm at sea level. The weight of the complete assembly is 180 lbs. It has passed the French Air Ministry 150-hour type test, and also has completed a special 250-hour endurance test comprising 30 hours at 100 shaft hp, 200 hours at 100 shaft hp, and 20 hours at lower power outputs.

Looking at the small auxiliary gas-turbine powerplants, one sees almost endless possibilities for these vibrationless, light-weight units which can be airborne to any part of the world and which can run on almost any kind of fuel. Among suggested uses for them, apart from driving electric alternators and generators, are sources of power for engine starting, lighting, refrigeration, heating, pumping and as prime movers for small aircraft, automobiles, trucks and small boats. This should be a field big enough to satisfy even the most ambitious engine manufacturer.

RUSSIAN FIGHTER

(Continued from page 34)

between overhauls and total life are likely to be set at very nominal figures, penalties due to the methods of quantity manufacture and expectancy of short operational life.

The new fighter is of an extremely advanced layout, combining 40°-sweptback wings with a sharply sweptback fin and T-positioned tailplane. The fuselage is of good aerodynamic form with an orthodox straight-through arrangement of the jet ducts. The nose ram entry is lipped above to maintain adequate airflow in nose-up position, and the intake ducts bifurcate around the pilot to the plenum chamber aft.

The pilot is seated well forward beneath a 360°-vision cockpit canopy and, in the version depicted, the armament is installed in the lower portion of the fuselage nose, under the cockpit flooring. This appears to consist of four cannon—possibly of 20-mm Sh-Vak type, a reliable weapon with a good rate of fire. Another variant of the same fighter has a noticeable armament bulge under the fuselage. It is probably that this bulge is necessitated by the installation of large cannon (37-mm?) for anti-tank and ground-attack duties.

An interesting feature is the adoption of a T-positioned cantilever tailplane mounted

on a large-area, sweptback fin and rudder. The tail sweep is approximately 40° which, combined with generous surface area, should provide adequate longitudinal control at high Mach numbers.

The wing is of high-speed section and has a 40° sweepback—some 5° more than is current on high-speed aircraft in the U. S. and Great Britain—and a slight droop anhedral which may have been adopted to reduce “Dutch roll,” a form of lateral oscillation. The wing has very little taper. Presumably automatic slots are installed in the leading edge to combat in part the poor low-speed lift characteristics of the sharply sweptback wing.

It is possible that, like Russian wartime fighters, internal equipment and armor have been kept down to a minimum, thus reducing the fighter's wing loading to something below that of contemporary Western fighters, and this feature, combined with moderate span and aspect ratio, should provide high maneuverability and good handling characteristics in high ‘C’ turns and pull-outs.

Bearing this in mind, service ceiling is likely to be upwards of 45,000 ft, and a conservative estimate of performance—based on the layout and assuming 5000 lbs thrust output from the engine—would place the Russian fighter as considerably faster than the *Vampire* and *Meteor*, F-80 and F-84. Maximum speed possibly may be as high as 690 mph (Mach 0.91), with comparable climb and ceiling, good rate of roll and combat maneuverability, lighter weight and inferior range. At medium altitudes, it probably would acquit itself well in combat with even the latest versions of the F-86 *Sabre* and could almost certainly reach and fight B-36 and B-50 formations.

Being a combination of one of the world's best service jet engines and German know-how in airframe design, this new Russian fighter appears to be a truly formidable opponent, equal to any fighter yet in service with other air forces.

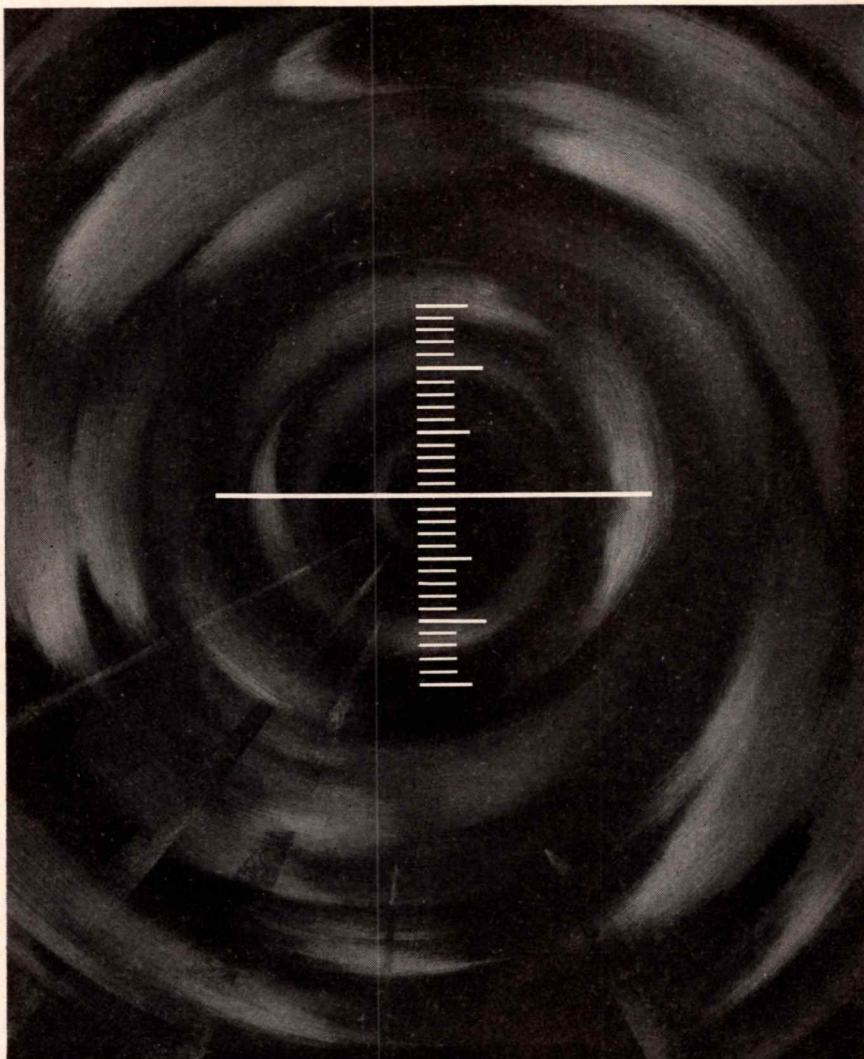
CONTRACT CHALLENGE

(Continued from page 17)

there has developed a tendency for all matters concerning this subject to be guided by some members of the legislative and executive branches, acting in more-or-less secret, or “executive” session. Also a phalanx of Congressional committees, loaded down with politics, economic policy and statutory phraseology—to mention only a few—combine with over a dozen executive departments and agencies concerned with diplomatic, political, budgetary, military and technical aspects to peruse and recommend drafts on these phases.

The considerable influence of Congressional personalities and committees in the past, on the determination of plant location, the restriction on the nature and size of strategic and critical raw material stockpiles and on legislative phraseology, further serves to illustrate the inherent complications.

The Department of Defense, the National Security Council, the National Security Resources Board and certain other specialized agencies compose the top policy team which directs over-all industrial mobilization and



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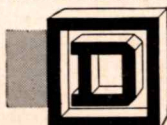
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planning. Under each of these, sub-departments and agencies work out the functional details. Furthermore, other agencies act as coordinators or observers.

The military air services carry out, on an operational basis, the policies and directives set by the above agencies. In this manner, their practical jurisdiction includes supervision of contract distribution, strategic location of prime defense industry, strategic materiel acquisition and inventory, and collection and dissemination of enemy industrial intelligence, among other things. Any malfunctioning or lack of coordination at the top policy level is reflected immediately in the results performed by these "working" sub-agencies. A delicate inter-agency balance is necessary to reach agreement—and this balance is oftentimes critical.

The Defense Department alone, for example, with its contract-authority commitment from Congress, plus gargantuan appropriated moneys, has the power to encourage small businesses (or through some obscure action, wipe them out), advance or retard the progress of monopoly, and generally have an unprecedented effect on business conditions and opportunity.

Operation of the relatively new "Central Military Procurement Information Office" of the Munitions Board (Department of Defense) is illustrative of the narrow conception which prevails in Washington concerning the possibilities of true contract distribution. Set up by Secretary Johnson in response to public demand in order to insure small business a share in defense con-

tracts without the need of employing unethical "influence peddlers" as Washington representatives, this office appears, to the casual business observer, to fulfill a definite service. It does.

However, except for the dissemination of practical, basic information on the routine of bidding for Government contracts, it falls considerably short of putting the smaller contractor in a competitive position to bid on defense contracts. It simply provides, in Washington, a central office where interested persons can obtain the same sort of information which always has been available in field offices throughout the country.

Another—and newer—procedure announced by the Munitions Board provides that, when comparable bids are received from large and small companies—and where competitive bidding is requested—the smaller company is to receive the award. As a practical matter, this placation deserves little applause from all but a relatively few "small businesses." The reasons are clear.

Small businesses still have no way of knowing how they can help on specific programs, information being kept close (again for security reasons) between the prime contractor and the military service concerned. Since it still remains for the smaller firms to learn of large contracts in advance, so they can plan and analyze their possible participation in sufficient time to make representations to the service concerned, the "information" office does not begin even to dent the bureaucratic stairway

up which every prospective subcontractor still must go.

Apart from the "information" office in Washington, this same mistake is repeated in most dealings between small companies and the service procurement agencies in question. Small companies, being unfamiliar with details of procurement on large-scale aircraft contracts and procurement plans, are unable to acquaint Wright Field and Pentagon officials with their specific capacity.

As a result, the larger companies with well-established representation at these points, get the contracts. Furthermore, the "negotiated," CPFF (cost plus fixed fee) contracts awarded these large firms do not encourage the holder to release parts thereof to subcontractors.

Production concentration, encouraged in this way by non-competitive bidding, has been advancing at an increasingly high rate in this country since the beginning of 1942, contrary to the encouragement of small businesses, or savings in public funds. It never will be known what the savings could have been in defense expenditures since the war if contracts had been let on a basis of competitive bidding, backed up by strong subcontracting policies.

The singular importance of this last-named factor, and the correspondingly slight attention it is given in official quarters, is at once the crux of the high-cost aircraft-production problem and the beckoning challenge which presents a shorter path to Government economy.

1950 Annual Directory of AIRFRAME AND POWERPLANT MANUFACTURERS

Initials under company names indicate manufacturers of: "E"—engines, reciprocating; "G"—gliders; "GT"—gas turbines; "H"—helicopters; "L"—lightplanes (personal); "M"—military planes; "P"—propellers; "R"—rockets, ramjets, pulsejets; and "T"—transport aircraft.

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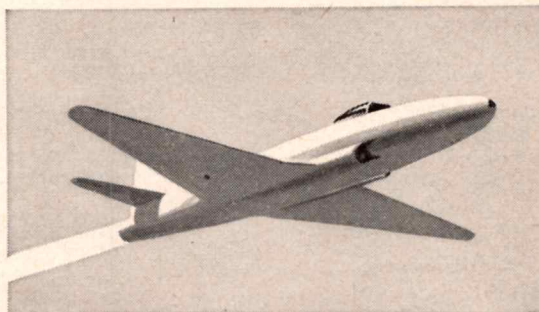
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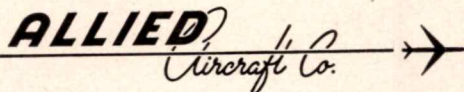
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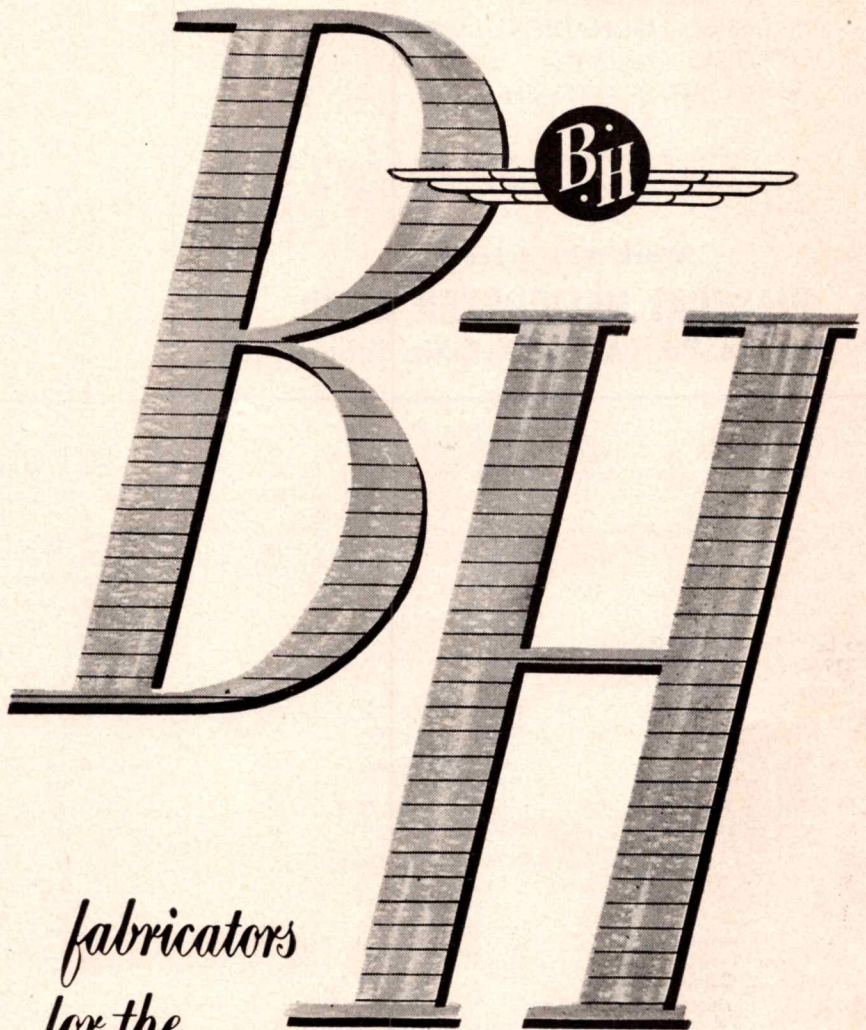
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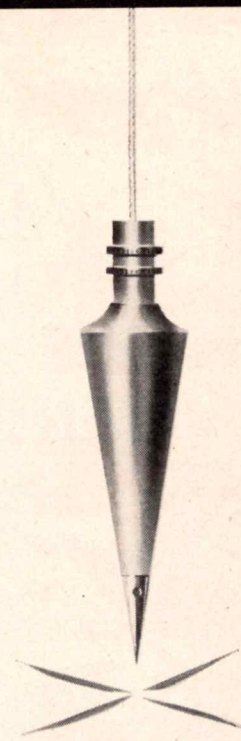
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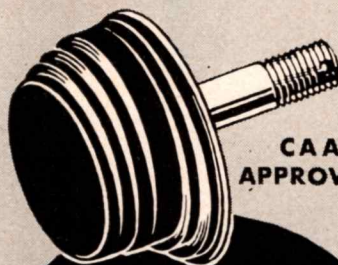
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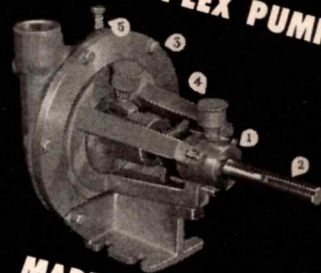
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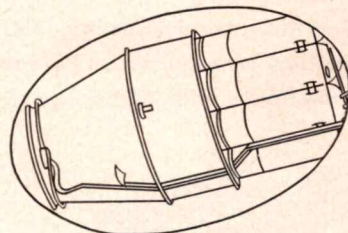
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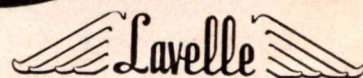
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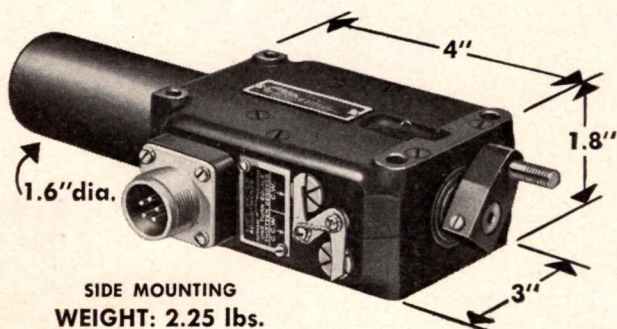
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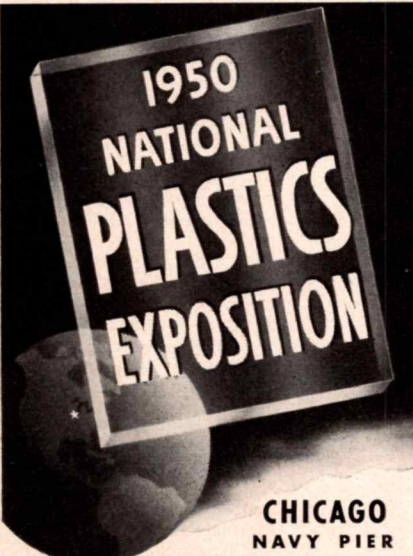
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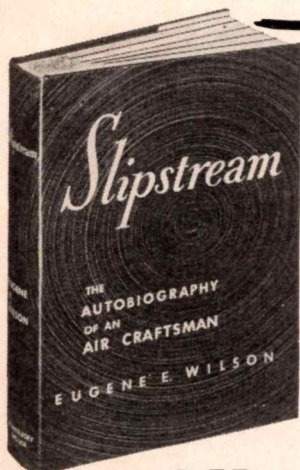
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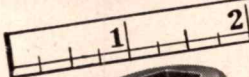
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Security Parachute & Equipment Co.

Clamps & Couplings

Adel Precision Products Corp.
Aero-Coupling Corp.
Air Associates, Inc.
Apex Machine & Tool Co.
Double T Products Co.
Dresser Industries, Inc.
Dresser Mfg. Div.
Ellinwood Industries
Exacta Mfg. Co., Inc.
Exacto Industries, Inc.
Flex-O-Tube Co.
Grandahl Tool & Machine Co.
Ideal Clamp Mfg. Co., Inc.
Marman Products Co., Inc.
Morse Chain Co.
Raybould Coupling Co.
Roylyn Associates
Schweizer Aircraft Corp.
Sperry Products, Inc.
Standard-Thomson Corp.
Thomas Associates
Witteck Manufacturing Co.

Clutches

Barbour Stockwell Co.
Borg-Warner Corp.
Rockford Clutch Div.
Chrysler Corp.
Amplex Manufacturing Co. Div.
The Hilliard Corp.
Lear, Inc.
Lundy Manufacturing Co.
Morse Chain Co.
Summers Gyroscope Co.
U. S. Hammered Piston Ring Co., Inc.
The S. K. Wellman Co.

Cockpit Enclosures

Aero-Flight Aircraft Corp.
The Fabri-Form Co.
Schweizer Aircraft Corp.
Swedlow Plastics Co.
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Aircraft Div.

Collector Rings & Exhaust Manifold Systems

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The Rotary Co.
The Ryan Aeronautical Co.
Solar Aircraft Co.
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Taylorcraft, Inc.
Texas Engineering & Mfg. Co.
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Juniper & Norris Co., Inc.
Shakespeare Products Co.
Titeflex, Inc.

Controls

Accessories

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All American Aircraft Products, Inc.
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Borg-Warner Corp.
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Pacific Scientific Co.
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American Chain & Cable Co., Inc.
Automotive & Aircraft Div.
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Cannon Mfg. Corp.
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Kenyon Instrument Co., Inc.
Lear, Inc.
Lisbon Engineering, Inc.
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L. Potter, Inc.
John A. Roebling's Sons Co.
Schweizer Aircraft Corp.
Servwell Products Co.
Shakespeare Products Co.
Southwest Products Co.
The Sperry Corp.
Vickers, Inc. Div.

Cables

Aerial Machine & Tool Corp.
All American Aircraft Products, Inc.
American Chain & Cable Co., Inc.
Automotive & Aircraft Div.
The Ansonia Electrical Co.
William Brand & Co.
Hackensack Cable Corp.
Macwhyte Co.
The Marquette Metal Products Co.
L. Potter, Inc.
Shakespeare Products Co.
Tennessee Coal, Iron & Railroad Co.

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The Aerotec Corp.
Airborne Equipment, Ltd.
AiResearch Manufacturing Co.
All American Aircraft Products, Inc.
Bendix Aviation Corp.
Eclipse-Pioneer Div.
Borg-Warner Corp.
Pesco Products Div.
Burklyn Co.
Chas. E. Chapin Co., Inc.
Lear, Inc.
Minneapolis-Honeywell Regulator Co.
Pacific Scientific Co.
Shakespeare Products Co.
Southwest Products Co.
The Weatherhead Co.
Woodward Governor Co.

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Aero Supply Mfg. Co., Inc.
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Eclipse-Pioneer Div.
Hoover Electric Co.
Lear, Inc.
Minneapolis-Honeywell Regulator Co.
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Square D Co.
Kollsman Instrument Div.
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Airborne Equipment, Ltd.
All American Aircraft Products, Inc.
Cook Electric Co.
Ex-Cell-O Corp.
Hoover Electric Co.
Lear, Inc.
United Aircraft Products, Inc.
The Weatherhead Co.
Woodward Governor Co.

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Airite Products Co.
All American Aircraft Products, Inc.
American Chain & Cable Co., Inc.
Automotive & Aircraft Div.
Bendix Aviation Corp.
Eclipse-Pioneer Div.
Borg-Warner Corp.
Pesco Products Div.
Flight Research Engineering Corp.
Lear, Inc.
Shakespeare Products Co.
Southwest Products Co.
Woodward Governor Co.

Pulleys

All American Aircraft Products, Inc.
Clary Multiplier Corp.
The Formica Co.
Westinghouse Electric Corp.

Covers

Cockpit

Airquipment Co.
Birma Mfg. Co., Inc.
Bogardus Brothers Inc.
Insulation Products Co.
Schweizer Aircraft Corp.
Security Parachute & Equipment Co.
Springfield Upholstery & Awning Co.

Engine & Propeller

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Otis Angier & Associates
Birma Mfg. Co., Inc.
Bogardus Brothers Inc.
Insulation Products Co.
Schweizer Aircraft Corp.
Security Parachute & Equipment Co.
Springfield Upholstery & Awning Co.

Wing & Tail Surface

Airquipment Co.
Otis Angier & Associates
Birma Mfg. Co., Inc.
Bogardus Brothers, Inc.
Double T Products Co.
Insulation Products Co.
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Security Parachute & Equipment Co.
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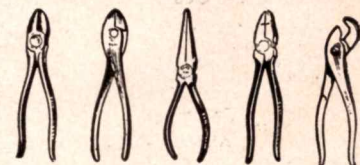
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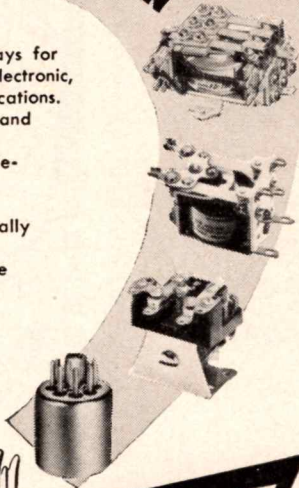
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Burton Electrical Engineering Co.
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Div.
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Howard B. Jones Div.
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Rubatex Div.
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Mines Equipment Co.
Molded Insulation Co.
National Precision Casting Corp.
Roylyn Inc.
Switchcraft, Inc.
Waltham Screw Co.

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Aircraftron Inc.
Automatic Electric Mfg. Co.
Cook Electric Co.
General Electric Co.
Joseph Pollak Corp.
Schwien Engineering Co.
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Hoffman Radio Corp.
Hoover Electric Co.
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The Leece-Neville Co.
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Tocco Div.
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Cook Electric Co.
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Hoover Electric Co.
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Master Specialty Co., Inc.
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Rhodes Lewis Co.
United Aircraft Products Inc.
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Airborne Equipment, Ltd.
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The Ohio Piston Co.
Transue & Williams Steel Forging Corp.
U. S. Hammered Piston Ring Co. Inc.
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Crankshafts

Atlas Drop Forge Co.
Ladish Co.
Merz Engineering Co.

RIVET PROBLEM—

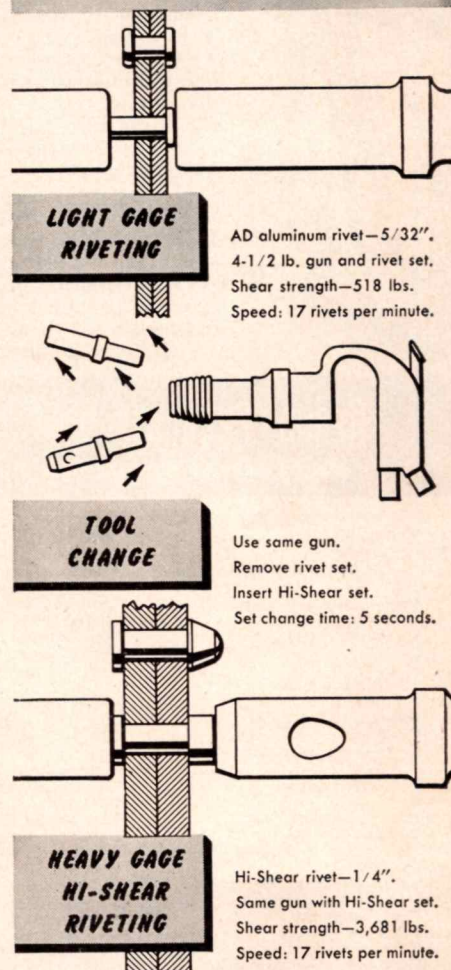
Change in light material gages to heavy gages—light loads to heavy loads.

METHOD—

*What fastener?
What tools?
How much time?*

SOLUTION—

HI-SHEAR rivets!



AD aluminum rivet—5/32".
4-1/2 lb. gun and rivet set.
Shear strength—518 lbs.
Speed: 17 rivets per minute.

Use same gun.
Remove rivet set.
Insert Hi-Shear set.
Set change time: 5 seconds.

Hi-Shear rivet—1/4".
Same gun with Hi-Shear set.
Shear strength—3,681 lbs.
Speed: 17 rivets per minute.

Hi-Shears permit the use of smaller and lighter riveting equipment . . . hence, more speed and less worker fatigue. Since Hi-Shear riveting is accomplished with standard riveting guns and squeezers, no expensive pullers or special single-purpose equipment is necessary.

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Air Associates, Inc.
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Boots Aircraft Nut Corp.
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Simmons Fastener Corp.
Stronghold Screw Products Inc.
Thomas Associates
Tinnerman Products Inc.
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William Brand & Co.
The Connecticut Hard Rubber Co.
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Insulation Products Co.
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Seaman Products Div.
Security Parachute & Equipment Co.
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Fram Corp.
General Motors Corp.
AC Spark Plug Div.
Lear Inc.
Romec Div.
Purolator Products, Inc.
Rhodes Lewis Co.
United Aircraft Products Inc.

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Aero Supply Mfg. Co., Inc.
Airborne Equipment, Ltd.
Air-Maze Corp.
Allen Aircraft Products, Inc.
Chas. E. Chapin Co., Inc.
Chrysler Corp.
Amplex Manufacturing Co. Div.
Cuno Engineering Corp.
Ellinwood Industries
Fram Corp.
Hilliard Corp.
Honan-Crane Corp.
Rhodes Lewis Co.
MacDonald Bros. Aircraft Ltd.
Purolator Products, Inc.
Roylyn Inc.
United Aircraft Products, Inc.
The Weatherhead Co.

Hydraulic Oil

Airborne Equipment, Ltd.
Aircraft Engineering Products, Inc.
Air-Maze Corp.
Bendix Aviation Corp.
Skinner Purifiers Div.
Chas. E. Chapin Co., Inc.
Chrysler Corp.
Amplex Manufacturing Co. Div.
Cuno Engineering Corp.
Ellinwood Industries
Hilliard Corp.
Honan-Crane Corp.
Kenyon Instrument Co., Inc.
Rhodes Lewis Co.
Phillips Petroleum Co.
Purolator Products, Inc.

Roylyn Inc.
Sperry Corp.
Sperry Gyroscope Co. Div.
Vickers, Inc. Div.
Sprague Engineering & Sales
United Aircraft Products Inc.
The Weatherhead Co.

Lubricating Oil

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Bendix Aviation Corp.
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Honan-Crane Corp.
Rhodes Lewis Co.
MacDonald Bros. Aircraft Ltd.
Purolator Products, Inc.
Roylyn, Inc.
Sprague Engineering & Sales
United Aircraft Products, Inc.

Fire Detectors & Alarms

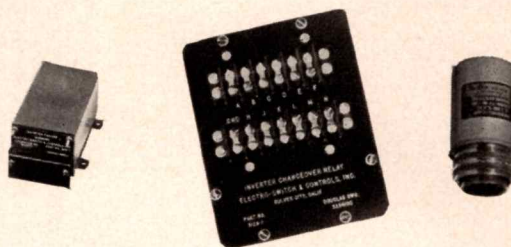
American-LaFrance-Foamite Corp.
Avion Instrument Corp.
Burndy Engineering Co., Inc.
Cardox Corp.
C-O-Two Fire Equipment Co.
Thomas A. Edison Inc.
Instrument Div.
Fenwal Inc.
Walter Kidde & Co., Inc.
Photoswitch Inc.
Simmonds Aerocessories, Inc.

Fire Extinguishers

Built-In Systems

American-LaFrance-Foamite Corp.
Ansul Chemical Co.
Cardox Corp.
Cook Electric Co.
C-O-Two Fire Equipment Co.
Walter Kidde & Co., Inc.

ELECTRICAL CONTROLS AND RELAYS



INVERTER CHANGE-OVER UNIT—Complete with built-in transformer and relays with a weight of approximately 6 pounds. Overall size, 5" x 5" x 6". Automatically transfers electrical loads to stand-by inverter in case of electrical failure of any one of the three phases of main inverter.

INVERTER FAILURE WARNING—This unit lights a warning light on control panel to indicate power failure of any phase of a three phase inverter.

FOUR POLE DT RELAY—We manufacture many types. The one illustrated is hermetically sealed, made to A-N specifications with approved plug-in connector.

Please write or wire for further details.

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8568 West Washington Boulevard, Culver City, California

National Foam System, Inc.
Simmonds Aeroaccessories, Inc.
Van's Air Service, Inc.

Portable

American-LaFrance-Foamite Corp.
Ansul Chemical Co.
Avica Corp.
Bostwick Laboratories, Inc.
Cardox Corp.
C-O-Two Fire Equipment Co.
Fog Nozzle International, Inc.
Walter Kidde & Co., Inc.
National Foam System, Inc.
Pyrene Manufacturing Co.
M. L. Snyder & Son

Fittings

Aircraft

Aero-Coupling Corp.
Airborne Equipment, Ltd.
Aircraft Engineering Products, Inc.
All American Aircraft Products, Inc.
Allied Appliance Co.
American Chain & Cable Co., Inc.
Automotive & Aircraft Div.
Barco Manufacturing Co.
Collins Engineering Co.
Cook Specialty Co.
Doak Aircraft Co., Inc.
Double T Products Co.
Elastic Stop Nut Corp. of America
Ellinwood Industries
Exacta Mfg. Co., Inc.
Flex-O-Tube Co.
Flodar Corp.
The Freeman Co.
V. L. Graf Co.
Grandahl Tool & Machine Co.
Koehler Aircraft Products Co., Inc.
Koehler Co.
Marman Products Co., Inc.
The Moulton Co., Inc.
National Precision Casting Corp.
The Parker Appliance Co.
Roylyn Inc.
Schweizer Aircraft Corp.
Sentinel Aircraft Inc.
Titeflex, Inc.
Waltham Screw Co.
The Warner Aircraft Corp.
Whittaker Cable Corp.
Wyman-Gordon Co.

Cable

Aero Bolt & Screw Co., Inc.
All American Aircraft Products, Inc.
American Chain & Cable Co., Inc.
Automotive & Aircraft Div.
Chain Belt Co.
Baldwin-Duckworth Div.
Collins Engineering Co.
Double T Products
The Freeman Co.
Macwhyte Co.
Molded Insulation Co.
The Moulton Co., Inc.
National Precision Casting Corp.
Pacific Scientific Co.
John A. Roebeling's Sons Co.
Titeflex, Inc.
Whitehead Stamping Co.

Tubing

Aero Bolt & Screw Co., Inc.
Aircraft Engineering Products, Inc.
All American Aircraft Products, Inc.
Allied Appliance Co.
American Tube Bending Co.
Barco Manufacturing Co.
Chiksan Co.
Collins Engineering Co.
Double T Products Co.
Ellinwood Industries
Exacta Mfg. Co., Inc.
The Firestone Tire & Rubber Co.
Flodar Corp.
Fluid Fittings Inc.
Lande Wood Products
National Precision Casting Corp.
Raybould Coupling Co.
Resistoflex Corp.
Roylyn Inc.
Scovill Mfg. Co.
Titeflex, Inc.
Tubing Seal-Cap, Inc.
The Weatherhead Co.
Whitehead Stamping Co.

Flaps

Cowling

All American Aircraft Products, Inc.
The Benson Mfg. Co.
Ellinwood Industries
Fletcher Aviation Corp.
Lavelle Aircraft Corp.
Schweizer Aircraft Corp.
Texas Engineering & Mfg. Co.

Sentinel Aircraft Inc.
Twin Coach Co.
Aircraft Div.
Woolf Aircraft Products, Inc.

Wing

All American Aircraft Products, Inc.
The Benson Mfg. Co.
Fletcher Aviation Corp.
Schweizer Aircraft Corp.
Texas Engineering & Mfg. Co.
Twin Coach Co.
Aircraft Div.
Weber Showcase & Fixture Co., Inc.
Aircraft Div.
Woolf Aircraft Products, Inc.

Flares & Signal Kits

Aerial Products, Inc.
Cook Electric Co.
The Kilgore Mfg. Co.
International Flare-Signal Div.
Rhodes Lewis Co.
Security Parachute & Equipment Co.

Flexible Drives

Air Associates, Inc.
Airborne Equipment, Ltd.
AiResearch Manufacturing Co.
Barbour Stockwell Co.
Breeze Corporations, Inc.
Burklyn Co.
Couplings, Inc.
Elliot Mfg. Co.
General Motors Co.
AC Spark Plug Div.
Hoover Electric Co.
Kenyon Instrument Co., Inc.
Lear, Inc.
Rhodes Lewis Co.
Lundy Manufacturing Co.
The Marquette Metal Products Co.
The Sperry Corp.
Vickers, Inc. Div.
F. W. Stewart Mfg. Corp.
Stow Manufacturing Co.
S. S. White Industrial Div.

Floats

Airborne Equipment, Ltd.
The Benson Mfg. Co.
Edo Corp.
Federal Aircraft Works
MacDonald Bros. Aircraft Ltd.
Mercury Aircraft Inc.
Schweizer Aircraft Corp.
Wollam Aircraft & Marine Products Co.

Fluids

Anti-Icing

Atlas Supply Co.
Aviation Electric Ltd.
Birma Mfg. Co., Inc.
Esso Standard Oil Co.
Aviation Sales Div.
Merix Chemical Co.
Shell Oil Co., Inc.

Brake

Atlas Supply Co.
Black Bear Co., Inc.
Permatex Co., Inc.
Puritan Co., Inc.

Hydraulic

Atlas Supply Co.
Black Bear Co., Inc.
Esso Standard Oil Co.
Aviation Sales Div.
Gulf Oil Corp.
R. M. Hollingshead Corp.
Industrial Aviation Div.
Monsanto Chemical Co.
Permatex Co., Inc.
Puritan Co., Inc.
Shell Oil Co., Inc.
Standard Oil Co. of California
Standard Oil Co. of Indiana
The Texas Co.
Union Oil Co.

Fuselage Sections

Aero-Flight Aircraft Corp.
All American Aircraft Products, Inc.
Fletcher Aviation Corp.
Lavelle Aircraft Corp.
Mercury Aircraft Inc.
Rohr Aircraft Corp.
The Ryan Aeronautical Co.
Schweizer Aircraft Corp.
Sentinel Aircraft Inc.
Texas Engineering & Mfg. Co.
Weber Showcase & Fixture Co., Inc.
Aircraft Div.
Woolf Aircraft Products, Inc.

Drill 'em

AT ANY ANGLE

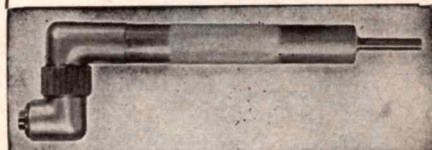
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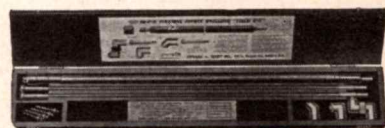
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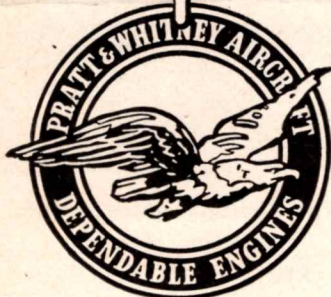
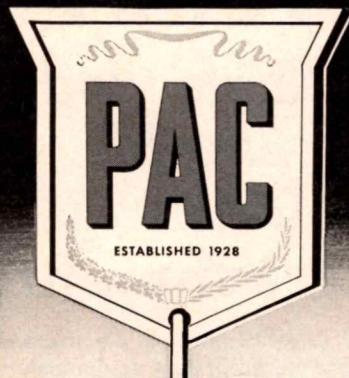
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Texas Engineering & Mfg. Co.
Weber Showcase & Fixture Co., Inc.
Aircraft Div.

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The Connecticut Hard Rubber Co.
Crane Packing Co.
Excelsior Leather Washer Mfg. Co., Inc.
Felt Products Mfg. Co.
The Firestone Tire & Rubber Co.
The Garlock Packing Co.
Gates Rubber Co.
Goodall Rubber Co.
The B. F. Goodrich Co.
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Rubatex Div.
Greene, Tweed & Co.
Hamilton-Wade Co.
Johns-Manville
Linear Inc.
Raybestos-Manhattan, Inc.
Roberts Toledo Rubber Co.
Vellumoid Co.
Victor Mfg. & Gasket Co.
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Accessories

Airborne Equipment, Ltd.
B. H. Aircraft Co., Inc.
AiResearch Manufacturing Co.
American Light Alloys, Inc.
The B. G. Corporation
Bendix Aviation Corp.
Bendix Products Div.
The Benson Mfg. Co.
Chicago Metal Hose Corp.
Control Products, Inc.
James Cunningham Son & Co.
Dresser Industries, Inc.
Dresser Mfg. Div.
Eaton Mfg. Co.
Ellinwood Industries
Engineered Products Co.
Foote Bros. Gear & Machine Corp.
General Controls Co.
General Electric Co.
General Motors Corp.
AC Spark Plug Div.
Jack & Heintz Precision Industries, Inc.
Insulation Products Co.
International Nickel Co., Inc.
Lear, Inc.
Romec Div.
Rhodes Lewis Co.
The Lewis Engineering Co.
Liteflex, Inc.
Meletron Corp.
National Precision Casting Corp.
The Parker Appliance Co.
Prenco Progress & Engrg. Corp. Ltd.
The Rotary Co.
Simmonds Aerocessories, Inc.
Solar Aircraft Co.
Specialties, Inc.
Sundstrand Machine Tool Co.
Stratos Corp.
Thompson Products, Inc.
U. S. Hammered Piston Ring Co., Inc.
Utica Drop Forge & Tool Corp.
Borg-Warner Corp.
Pesco Products Div.
Westinghouse Electric Corp.
Woodward Governor Co.
Wyman-Gordon Co.

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AiResearch Manufacturing Co.
American Light Alloys, Inc.
Lavelle Aircraft Corp.
The Ohio Piston Co.
The Rotary Co.
The Ryan Aeronautical Co.
Solar Aircraft Co.
Westinghouse Electric Corp.

Compressors

AiResearch Manufacturing Co.
American Light Alloys, Inc.
Austenal Laboratories, Inc.
Lavelle Aircraft Corp.

Rhodes Lewis Co.
Solar Aircraft Co.
The Steel Improvement & Forge Co.
Stratos Corp.
Thompson Products, Inc.
Westinghouse Electric Corp.

Turbines

AiResearch Manufacturing Co.
American Light Alloys, Inc.
Austenal Laboratories, Inc.
Lavelle Aircraft Corp.
Solar Aircraft Co.
The Steel Improvement & Forge Co.
Stratos Corp.
Thompson Products, Inc.
Westinghouse Electric Corp.

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Aero Bolt & Screw Co., Inc.
Adel Precision Products Corp.
Arens Controls, Inc.
Auburn Manufacturing Co.
H. H. Buggie & Co.
The H. O. Canfield Co.
Champion Corp.
Dzus Fastener Co., Inc.
General Cement Mfg. Co.
Goodall Rubber Co.
The B. F. Goodrich Co.
Insuline Corp. of America
Liteflex, Inc.
Raybestos-Manhattan, Inc.
Mines Equipment Co.
National Motor Bearing Co., Inc.
Arrowhead Rubber Co. Div.
Roberts Toledo Rubber Co.
Whitehead Stamping Co.

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Adams Rite Manufacturing Co.
Aerial Machine & Tool Corp.
Aero Bolt & Screw Co., Inc.
Aero Supply Mfg. Co., Inc.
Airborne Equipment, Ltd.
Aircraft Engineering Products, Inc.
Aircraft Products Company
Allen Mfg. Co.
American Chain & Cable Co., Inc.
Automotive & Aircraft Div.
Apex Machine & Tool Co.
Atlantic Master Craft Co.
Boots Aircraft Nut Corp.
Cherry Rivet Co.
Clary Multiplier Corp.
Continental Screw Co.
Dzus Fastener Co., Inc.
Elastic Stop Nut Corp. of America
Ellinwood Industries
Fox Co.
The Freeman Co.
General Cement Mfg. Co.
Grandahl Tool & Machine Co.
The B. F. Goodrich Co.
The Guarantee Specialty Manufacturing Co.
Hartwell Manufacturing Co.
Heli-Coil Corp.
Hi-Shear Rivet Tool Co.
Insuline Corp. of America
Liteflex, Inc.
The Moulton Co., Inc.
Moynahan Bronze Co., Inc.
The Nylok Co.
Pheoll Manufacturing Co.
Quadruga Mfg. Co.
Thomas Associates
The Tomson & Sessions Co.
The Turner Brass Works
Waltham Screw Co.
Whitehead Stamping Co.
Wrought Washer Mfg. Co.

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Aerial Machine & Tool Corp.
Air Associates, Inc.
Flight Safety, Inc.
Irving Air Chute Co., Inc.
L. Potter, Inc.
Security Parachute & Equipment Co.

Heaters

Cabin

Aero-Flight Aircraft Corp.
AiResearch Manufacturing Co.
Juniper & Norris Co., Inc.
Rhodes Lewis Co.
The Ryan Aeronautical Co.
Stewart-Warner Corp.
South Wind Div.
Surface Combustion Corp.

Thermal Anti-Icing

AiResearch Manufacturing Co.
American Air Filter Co., Inc.
Nelson Div.

Fairchild Engine & Airplane Corp.
Al-Fin Div.
Rhodes Lewis Co.
Pacific Airmotive Corp.
The Ryan Aeronautical Co.
Stewart-Warner Corp.
South Wind Div.
Surface Combustion Corp.
Hanlon & Wilson Co.

Hose Assemblies & Clamps

Aero-Coupling Corp.
Aeroquip Corp.
The American Hardware Corp.
Corbin Screw Div.
American Ventilation Hose Co.
Atlantic Metal Hose Co., Inc.
Atlas Supply Co.
Avica Corp.
Chicago Metal Hose Corp.
Chiksan Co.
Ellinwood Industries
Flex-O Tube Co.
Gates Rubber Co.
Goodall Rubber Co.
The B. F. Goodrich Co.
V. L. Graf Co.
Ideal Clamp Mfg. Co., Inc.
Lifeflex, Inc.
Marman Products Co., Inc.
Raybestos-Manhattan, Inc.
Prencos Progress & Engrg. Corp. Ltd.
Resistoflex Corp.
Roylinc Inc.
Scovill Mfg. Co.
Standard-Thomson Corp.
Clifford Manufacturing Co. Div.
Tinnerman Products, Inc.
Waltham Screw Co.
Weatherhead Co.

Hydraulic Equipment

Accessories

Adel Precision Products Corp.
Aeroquip Corp.
Air Associates, Inc.
Airborne Equipment, Ltd.
Aircraft Engineering Products, Inc.
Aircraft Products Co.
Aviation Electric Ltd.
Barco Manufacturing Co.
Bendix Aviation Corp.
Bendix Products Div.
Pacific Div.
Bobrick Mfg. Corp.
Chiksan Co.
Crane Packing Co.
Electrol, Inc.
Ellinwood Industries
Ex-Cell-O Corp.
The Freeman Co.
General Controls Co.
V. L. Graf Co.
Great Lakes Manufacturing Corp.
The Herman Machine & Tool Co.
Hycon Mfg. Co.
Kenyon Instrument Co., Inc.
Lear, Inc.
Rhodes Lewis Co.
The Marquette Metal Products Co.
Mercury Aircraft Inc.
National Motor Bearing Co., Inc.
Arrowhead Rubber Co. Div.
National Precision Casting Corp.
The New York Air Brake Co.
The Parker Appliance Co.
Prencos Progress & Engrg. Corp., Ltd.
Saval Co.
Simmonds Aerocessories, Inc.
The Sperry Corp.
Vickers, Inc. Div.
Sperry Gyroscope Co., Div.
Sprague Engineering & Sales
Tubing Seal-Cap, Inc.
The Warner Aircraft Corp.
Borg-Warner Corp.
Pesco Products Div.
Waterman Engineering Co.
Woolf Aircraft Products, Inc.

Control Units

Adel Precision Products Corp.
Air Associates, Inc.
Airborne Equipment, Ltd.
Aircraft Engineering Products, Inc.
Aircraft Products Co.
Aviation Electric Ltd.
Bendix Aviation Corp.
Pacific Div.
Bobrick Mfg. Corp.
Cook Electric Co.
Electrol, Inc.
Ellinwood Industries
Ex-Cell-O Corp.
The Freeman Co.
Great Lakes Manufacturing Corp.
Kenyon Instrument Co., Inc.
Hycon Mfg. Co.
Lear, Inc.
Rhodes Lewis Co.

Meletron Corp.
Prencos Progress & Engrg. Corp. Ltd.
Saval Co.
Simmonds Aerocessories, Inc.
The Sperry Corp.
Vickers, Inc. Div.
Sperry Products, Inc.
United Aircraft Products, Inc.
Waterman Engineering Co.
The Warner Aircraft Corp.

Power Units

Adel Precision Products Corp.
Air Associates, Inc.
Airborne Equipment, Ltd.
Aircraft Products Co.
Aviation Electric Ltd.
Bendix Aviation Corp.
Pacific Div.
Chicago Pneumatic Tool Co.
Denison Engineering Co.
Electrol, Inc.
Ellinwood Industries
The Freeman Co.
Great Lakes Manufacturing Co.
Greer Hydraulics, Inc.
Jack & Heintz Precision Industries, Inc.
Lear, Inc.
Romec Div.
Rhodes Lewis Co.
Miller Motor Co.
The New York Air Brake Co.
Lyon-Raymond Corp.
Saval Co.
The Sperry Corp.
Vickers, Inc. Div.
Sprague Engineering & Sales
The Warner Aircraft Corp.
The Weatherhead Co.

Ignition Accessories (Engine)

Airborne Equipment, Ltd.
The American Brass Co.
American Metal Hose Branch
Aviation Electric Ltd.
Belden Mfg. Co.
Bendix Aviation Corp.
Scintilla Magneto Div.
The B G Corp.
Breeze Corporations, Inc.
Electric Auto-Lite Co.
Wire & Cable Div.
General Electric Co.
General Motors Corp.
AC Spark Plug Div.
Packard Electric Div.
Great American Industries, Inc.
Conn. Telephone & Electric Div.
Lear, Inc.
Menaugh-Dutterer Co.
Titeflex, Inc.

Injection Equipment

Fuel

Airborne Equipment Ltd.
Bendix Aviation Corp.
Bendix Products Div.
Fuelcharger Corp.
Ellinwood Industries
Engineered Products Co.
General Controls Co.
General Motors Corp.
AC Spark Plug Div.
Lear, Inc.
Romec Div.
The Parker Appliance Co.
United Aircraft Products Inc.
The Weatherhead Co.

Water-Alcohol

Adel Precision Products Corp.
Airborne Equipment, Ltd.
Bendix Aviation Corp.
Bendix Products Div.
Ellinwood Industries
General Controls Co.
Lear, Inc.
Romec Div.
Pacific Scientific Co.

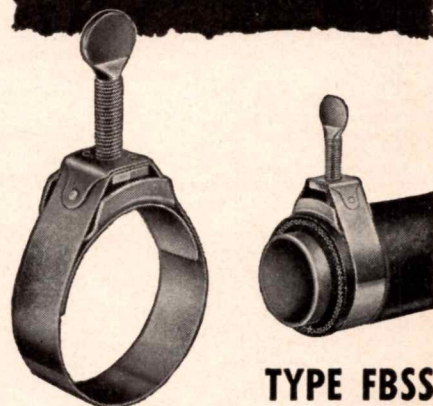
Instruments & Gages

Electrical

Abrams Instrument Corp.
Airborne Equipment, Ltd.
American Machine & Metals, Inc.
United States Gauge Div.
Aviation Electric Ltd.
Avion Instrument Corp.
Bendix Aviation Corp.
Eclipse-Pioneer Div.
Scintilla Magneto Div.
Cole Instrument Co.
Control Products, Inc.
Cook Electric Co.
Thomas A. Edison, Inc.
Instrument Div.

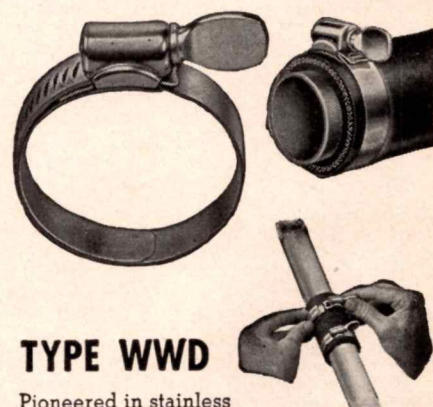
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Lear, Inc.
Rhodes Lewis Co.
The Lewis Engineering Co.
The M. B. Manufacturing Co., Inc.
Minneapolis-Honeywell Regulator Co.
Brown Instrument Div.
Pacific Scientific Co.
Safe Flight Instrument Corp.
Schwien Engineering Co.
Specialties, Inc.
Square D Co.
Kollsman Instrument Div.
Westinghouse Electric Corp.
Weston Electrical Instrument Corp.

Engine

Airborne Equipment, Ltd.
American Machine & Metals, Inc.
United States Gauge Div.
Aviation Electric Ltd.
Barbour Stockwell Co.
Bendix Aviation Corp.
Eclipse-Pioneer Div.
C. L. Berger & Sons, Inc.
General Electric Co.
General Motors Corp.
AC Spark Plug Div.
Lear, Inc.
Lindberg Instrument Co.
Pacific Scientific Co.
Pyrometer Instrument Co., Inc.
Scott Aviation Corp.
Square D Co.
Kollsman Instrument Div.
Weston Electrical Instrument Corp.

Flight

Aero Instrument Corp.
Aircraft Indicators Co.
American Machine & Metals, Inc.
United States Gauge Div.
American Paulin System
Aviation Electric Ltd.
Bendix Aviation Corp.
Eclipse-Pioneer Div.
Thomas A. Edison, Inc.
Instrument Div.
General Electric Co.
General Motors Corp.
AC Spark Plug Div.
Hastings Instrument Co., Inc.
Lear, Inc.
The Lewis Engineering Co.
The M. B. Manufacturing Co., Inc.
Rieker Instrument Co.
Safe Flight Instrument Corp.
Schwien Engineering Co.
Specialties, Inc.
Square D Co.
Kollsman Instrument Div.
Summers Gyroscope Co.
Weston Electrical Instrument Corp.

Flight Test

Aerolab Development Co., Inc.
American Machine & Metals, Inc.
United States Gauge Div.
Aviation Electric Ltd.
Bendix Aviation Corp.
Pacific Div.
Thomas A. Edison Inc.
Instrument Div.
General Electric Co.
General Motors Corp.
AC Spark Plug Div.
The Lewis Engineering Co.
Miles Reproducer Co.
William Miller Co.
Minneapolis-Honeywell Regulator Co.
Minneapolis-Honeywell Regulator Co.
Brown Instrument Div.
Specialties, Inc.
Sperry Corp.
Sperry Gyroscope Co., Div.
Square D Co.
Kollsman Instrument Div.
Stanley Aviation Corp.

Fuel

Airborne Equipment, Ltd.
American Machine & Metals, Inc.
United States Gauge Div.
Bendix Aviation Corp.
Bendix Products Div.
Eclipse-Pioneer Div.
Thomas A. Edison Inc.
Instrument Div.
General Motors Corp.
AC Spark Plug Div.
Rhodes Lewis Co.
The Liquidometer Corp.
Minneapolis-Honeywell Regulator Co.
Simmonds Aerocessories, Inc.
Stanley Aviation Corp.
United Aircraft Products, Inc.

Weston Electrical Instrument Corp.

Navigation

Aircraft Radio Corp.
American Hydromath Co.
American Machine & Metals, Inc.
United States Gauge Div.
American Paulin System
Aviation Electric Ltd.
Bendix Aviation Corp.
Eclipse-Pioneer Div.
Collins Radio Co.
Elgin National Watch Co.
Federal Telephone & Radio Corp.
Flight Research Engineering Corp.
General Electric Co.
General Motors Corp.
AC Spark Plug Div.
W. & L. E. Gurley
Hastings Instrument Co., Inc.
Jardur Aviation Co.
Lear, Inc.
Millar Instrument Co., Inc.
Minneapolis-Honeywell Regulator Co.
National Aeronautical Corp.
Pan-American Navigation Service
Schwien Engineering Co.
Sperry Corp.
Sperry Gyroscope Co. Div.
Square D Co.
Kollsman Instrument Div.
Transmitter Equipment Mfg. Co., Inc.
Weems System of Navigation

Insulating Materials

Ambroid Co.
The B. G. Corp.
Birna Mfg. Co., Inc.
William Brand & Co.
Continental-Diamond Fibre Co.
Dow Corning Corp.
The Formica Co.
General Cement Mfg. Co.
General Electric Co.
Great American Industries, Inc.
Rubatex Div.
Industrial Sound Control, Inc.
Insulation Products Co.
Irvington Varnish & Insulator Co.
Johns-Manville
Merix Chemical Co.
Mica Insulator Co.
Minnesota Mining & Mfg. Co.
Adhesives & Coatings Div.
The Moulton Co., Inc.
Raybestos-Manhattan, Inc.
Sauereisen Cements Co.
Seaman Paper Co.
Seaman Products Div.
Standard Varnish Works
The H. I. Thompson Co.
Westinghouse Electric Corp.

Inter-Communication Systems

Air Associates, Inc.
Aircraft Radio Corp.
Aircraftron Inc.
Cole Instrument Co.
Collins Radio Co.
Great American Industries, Inc.
Connecticut Telephone & Electric Div.
Molded Insulation Co.
Transmitter Equipment Mfg. Co., Inc.

Landing Gear

Main-Wheel Assemblies

Adel Precision Products Corp.
Aero-Flight Aircraft Corp.
Airborne Equipment, Ltd.
Bendix Aviation Corp.
Bendix Products Div.
The Cleveland Pneumatic Tool Co.
The Electric Sprayit Co.
Ellinwood Industries
The B. F. Goodrich Co.
The Goodyear Tire & Rubber Co., Inc.
Menasco Manufacturing Co.
Merz Engineering Co.
Schweizer Aircraft Corp.
Taylorcraft, Inc.
United Aircraft Products, Inc.

Nosewheel Assemblies

Adel Precision Products Corp.
Aero-Flight Aircraft Corp.
Airborne Equipment, Ltd.
Bendix Aviation Corp.
Bendix Products Div.
The Cleveland Pneumatic Tool Co.
The Electric Sprayit Co.
Ellinwood Industries
The B. F. Goodrich Co.
The Goodyear Tire & Rubber Co.
Menasco Manufacturing Co.

Merz Engineering Co.
Schweizer Aircraft Corp.
Sentinel Aircraft, Inc.
United Aircraft Products, Inc.

Shock Struts

Adel Precision Products Corp.
Aero-Flight Aircraft Corp.
Airborne Equipment, Ltd.
Bendix Aviation Corp.
Bendix Products Div.
The Cleveland Pneumatic Tool Co.
The Electric Sprayit Co.
Ellinwood Industries
Ex-Cell-O Corp.
The Freeman Co.
Hycon Mfg. Co.
Ladish Co.
Menasco Manufacturing Co.
Merz Engineering Co.
Schweizer Aircraft Corp.
United Aircraft Products, Inc.
Wyman-Gordon Co.

Tail Wheel Assemblies

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Bendix Aviation Corp.
Bendix Products Div.
The Cleveland Pneumatic Tool Co.
The Electric Sprayit Co.
Ellinwood Industries
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Hycon Mfg. Co.
Menasco Manufacturing Co.
Merz Engineering Co.
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Scott Aviation Corp.
United Aircraft Products, Inc.
Taylorcraft, Inc.

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Greer Hydraulics, Inc.
R. M. Hollingshead Corp.
Industrial Aviation Div.
Rhodes Lewis Co.
Roylyn Inc.
Scovill Mfg. Co.
Weber Showcase & Fixture Co., Inc.
Aircraft Div.

Life-Saving Equipment

The Goodyear Tire & Rubber Co., Inc.
Security Parachute & Equipment Co.

Lighting Equipment

Cabin & Cockpit

Cannon Mfg. Corp.
Cannon Electric Development Div.
General Electric Co.
Grimes Mfg. Co.
Rhodes Lewis Co.
Soderberg Manufacturing Co., Inc.

Indicator Lights

General Electric Co.
Great American Industries, Inc.
Connecticut Telephone & Electric Div.
Grimes Mfg. Co.
Hetherington, Inc.
Rhodes Lewis Co.
Soderberg Manufacturing Co., Inc.

Landing Lights

Aviation Accessories Corp.
General Electric Co.
Grimes Mfg. Co.
Rhodes Lewis Co.
Soderberg Manufacturing Co., Inc.
Swivelier Co., Inc.
Westinghouse Electric Corp.

Navigation Lights

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Grimes Mfg. Co.
Rhodes Lewis Co.
Signet Development Co.
Soderberg Manufacturing Co., Inc.
Westinghouse Electric Corp.

Magnetos

Airborne Equipment, Ltd.
Aviation Electric Ltd.
Bendix Aviation Corp.
Scintilla Magneto Div.
General Electric Co.
Great American Industries, Inc.
Connecticut Telephone & Electric Div.

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Weston Electrical Instrument Corp.

Mufflers, Engine Exhaust

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Lekote Products Co. of N. Y. Inc.
The Rotary Co.
The Ryan Aeronautical Co.
Taylorcraft, Inc.
Woolf Aircraft Products, Inc.

Name Plates & Signs

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Eljay Corp.
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Meyercoord Co.
National Precision Casting Corp.
Servwell Products Co.
Virginia Plak Co.
Zenith Plastics Co.

Oxygen Equipment

The Aerotec Corp.
American Machine & Metals, Inc.
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Bendix Aviation Corp.
Eclipse-Pioneer Div.
Chicago Metal Hose Corp.
Chiksan Co.
General Motors Corp.
AC Spark Plug Div.
Ohio Chemical & Surgical Equipment Co.
Air Reduction Co., Inc. Div.
Rhodes Lewis Co.
Puritan Compressed Gas Corp.
Scott Aviation Corp.

Paints & Varnishes

Acme White Lead & Color Works
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Ambroid Co.
Atlas Powder Co.
Industrial Finishes Dept.
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The Midland Paint & Varnish Co.
Pierce & Stevens, Inc.
Randolph Products Co.
The Sherwin-Williams Co.
Standard Varnish Works
Vita-Var Corp.
The Watson-Standard Co.

Parachutes

General Textile Mills, Inc.
Irving Air Chute Co., Inc.
Pioneer Parachute Co., Inc.
Reliance Mfg. Co.
Parachute Div.
Security Parachute & Equipment Co.
Prevost F. Smith Parachute Co.

Plastic Parts

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Aetna Plywood & Veneer Co.
Aircraft Components, Inc.
Aircraft Specialties Co., Inc.
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Schweizer Aircraft Corp.
Swedlow Plastics Co.
Tucker Industries, Inc.
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S. S. White Industrial Div.
Zenith Plastic Co.

Pressure Switches

The Aerotec Corp.
Air Associates, Inc.

Airborne Equipment, Ltd.
 American Machine & Metals, Inc.
 United States Gauge Div.
 Bendix Aviation Corp.
 Eclipse-Pioneer Div.
 Burndy Engineering Co., Inc.
 Cole Instrument Co.
 General Controls Co.
 Great Lakes Manufacturing Corp.
 Kenyon Instrument Co., Inc.
 Lear, Inc.
 Romec Div.
 Rhodes Lewis Co.
 McQuay-Norris Mfg. Co.
 Meletron Corp.
 Minneapolis-Honeywell Regulator Co.
 Schwen Engineering Co.
 Square D Co.
 Kollsman Instrument Div.
 Standard-Thomson Corp.
 Stewart-Warner Corp.
 South Wind Div.

Pumps

Air

Airborne Equipment, Ltd.
 American Light Alloys, Inc.
 Aviation Electric, Ltd.
 Bendix Aviation Corp.
 Eclipse-Pioneer Div.
 Borg-Warner Corp.
 Pesco Products Div.
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 Ellinwood Industries
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 Lear, Inc.
 Romec Div.
 Rhodes Lewis Co.
 M. C. Manufacturing Co.
 Pacific Scientific Co.
 Schwitzer-Cummins Co.
 Stratos Corp.
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 Airborne Equipment, Ltd.
 American Light Alloys, Inc.
 Bendix Aviation Corp.
 Bendix Products Div.
 Eclipse-Pioneer Div.
 Borg-Warner Corp.
 Pesco Products Div.
 The Cleveland Pneumatic Tool Co.
 Denison Engineering Co.
 Eastern Industries, Inc.
 Ellinwood Industries
 General Motors Corp.
 AC Spark Plug Div.
 Great Lakes Manufacturing Co.
 Lear, Inc.
 Romec Div.
 Rhodes Lewis Co.
 M. C. Manufacturing Co.
 Pacific Scientific Co.
 Prentco Progress & Engrg. Corp., Ltd.
 Small Motors, Inc.
 Sundstrand Machine Tool Co.
 Thompson Products
 United Aircraft Products, Inc.

Oil

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 American Light Alloys, Inc.
 Borg-Warner Corp.
 Pesco Products Div.
 The Cleveland Pneumatic Tool Co.
 Denison Engineering Co.
 Eastern Industries, Inc.
 Eaton Mfg. Co.
 Ellinwood Industries
 The Freeman Co.
 Great Lakes Manufacturing Co.
 Lear, Inc.
 Romec Div.
 Rhodes Lewis Co.
 The New York Air Brake Co.
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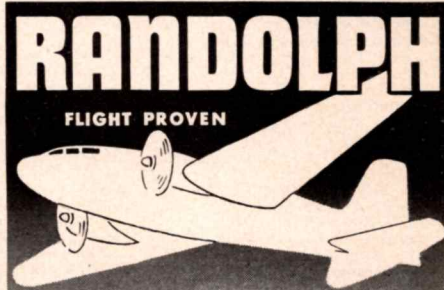
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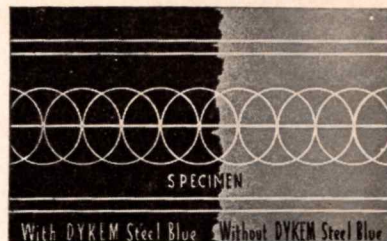
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Harvey-Wells Electronics, Inc.

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Miles Reproducer Co.
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Radio Corporation of America
RCA Victor Div.
Telephonics Corp.

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Bendix Aviation Corp.
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Chatham Electronics Corp.
Communications Co., Inc.
Doolittle Radio Inc.
General Electric Co.
Great American Industries Inc.
Conn. Telephone & Electric Div.
Harvey-Wells Electronics, Inc.
Hoffman Radio Corp.
Hastings Instrument Co., Inc.
Hycon Mfg. Co.
Lear, Inc.
Molded Insulation Co.
National Aeronautical Corp.
National Electronics Laboratories, Inc.
Radio Corporation of America
RCA Victor Div.
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Bendix Radio Div.
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Collins Radio Co.
Communications Co., Inc.
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Hycon Mfg. Co.
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Molded Insulation Co.
National Electronics Laboratories Inc.
National Aeronautical Corp.
Radio Corporation of America

RCA Victor Div.
Transmitter Equipment Mfg. Co. Inc.
Telephonics Corp.
Westinghouse Electric Corp.

Refrigeration Equipment

Airborne Equipment, Ltd.
AirResearch Manufacturing Co.
Mansfield Aircraft Products Co.
Rhodes Lewis Co.
Stratos Corp.
Weber Showcase & Fixture Co. Inc.
Aircraft Division
Westinghouse Electric Corp.

Release Mechanisms

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Dayton Aircraft Products, Inc.
Lear, Inc.
Rhodes Lewis Co.
Schweizer Aircraft Corp.
United Aircraft Products, Inc.

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The Hi-Shear Rivet Tool Co.
The Lamson & Sessions Co.
National Rivet & Mfg. Co.
Waltham Screw Co.

Rotors, Helicopter

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Aircraft Div.

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Sauerisen Cements Co.
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Crane Packing Co.
Schwitzer-Cummins Corp.
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The B. F. Goodrich Co.
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Texas Engineering & Mfg. Co.
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Aircraft Div.

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The M B Manufacturing Co., Inc.
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Robinson Aviation, Inc.
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The H. O. Canfield Co.
The Connecticut Hard Rubber Co.
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The M B Manufacturing Co., Inc.
The Moulton Co., Inc.
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Robinson Aviation, Inc.
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Skis

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Scintilla Magneto Div.
Champion Spark Plug Co.
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Lavelle Aircraft Corp.
Mercury Aircraft Inc.
Schweizer Aircraft Corp.
Sentinel Aircraft Inc.
Texas Engineering & Mfg. Co.
Weber Showcase & Fixture Co., Inc.
Aircraft Div.
Zenith Plastics Co.

Stall-Warning Indicators

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Starters (Engine)

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Weber Showcase & Fixture Co., Inc.
Aircraft Div.

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Fletcher Aviation Corp.
The B. F. Goodrich Co.
The Goodyear Tire & Rubber Co., Inc.
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Mercury Aircraft Inc.
Rohr Aircraft Corp.
Rhodes Lewis Co.
Schweizer Aircraft Corp.
Texas Engineering & Mfg. Co.
Taylorcraft, Inc.
Twin Coach Co. Aircraft Div.
United Aircraft Products Inc.
Wolf Aircraft Products, Inc.
Weber Showcase & Fixture Co., Inc.
Aircraft Div.

Oil

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The Benson Mfg. Co.
Ellinwood Industries
Fletcher Aviation Corp.
The Goodyear Tire & Rubber Co., Inc.
Lavelle Aircraft Corp.
Rhodes Lewis Co.
MacDonald Bros. Aircraft Ltd.
Mercury Aircraft Inc.
Rohr Aircraft Corp.
Schweizer Aircraft Corp.
Taylorcraft, Inc.
Texas Engineering & Mfg. Co.
Weber Showcase & Fixture Co., Inc.
Aircraft Div.
Wolf Aircraft Products, Inc.

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Lavelle Aircraft Corp.
Mercury Aircraft Inc.
Rohr Aircraft Corp.
Rhodes Lewis Co.
Schweizer Aircraft Corp.
Texas Engineering & Mfg. Co.
Taylorcraft, Inc.
Wolf Aircraft Products, Inc.
Weber Showcase & Fixture Co. Inc.
Aircraft Div.

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Pacific Scientific Co.
Rhodes Lewis Co.
Stratos Corp.
Standard Thomson Corp.
Thermo-Electric Co., Inc.
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Pyrometer Instrument Co., Inc.
Pacific Scientific Co.
Rhodes Lewis Co.
United Aircraft Products Inc.
Weston Electrical Instrument Corp.

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General Tire & Rubber Co.
The B. F. Goodrich Co.
The Goodyear Tire & Rubber Co., Inc.
Frank G. Schenuit Rubber Co.
Thompson Aircraft Tire Corp.
U. S. Rubber Co.

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Foote Bros. Gear & Machine Corp.
The Steel Products Engineering
Western Gear Works

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Resistoflex Corp.
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Standard Thomson Corp.
Titeflex, Inc.
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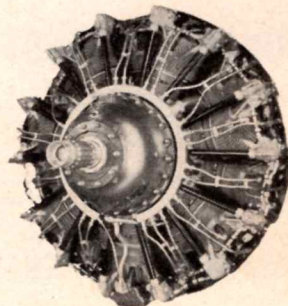
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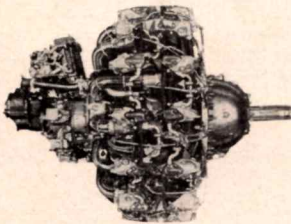
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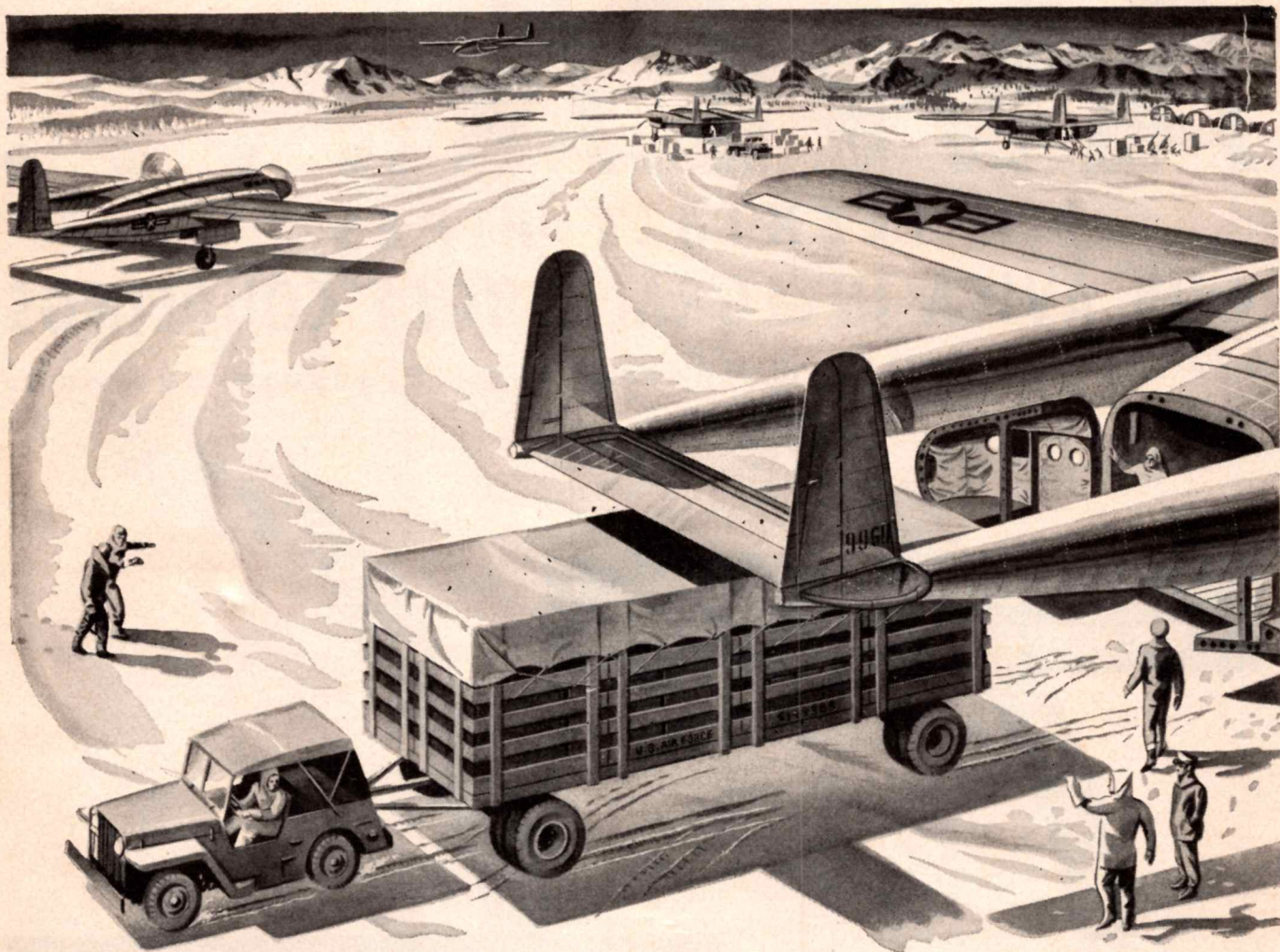
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Via the Air Route

The Military Air Transport Service (MATS) contributes to the mobility of the Armed Forces by airlifting cargo and personnel *whenever* and *wherever* needed to fulfill national military requirements.

Fairchild C-119 Packets, soon to be flying for the Military Air Transport Service, help fulfill this vital air transportation mission. Capable of carrying 64 passengers or 10 tons of cargo, this twin-engine transport and cargo plane has the *versatility* to accomplish numerous types of operations required via the MATS Air Route.

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height allows for rapid handling of cargo, eliminating the necessity for extra ground handling equipment. Airplane engines and parts, bulky communication equipment, vehicles, tanks and field kitchens are some of the many military items the Fairchild C-119 carries with ease. In addition to its utility as a cargo plane, the Packet is equally efficient for air-evacuation, air-sea rescue, and personnel transport.

The C-119 is one of a series of Fairchild transport planes which will continue to play a versatile role in the operations of the world wide Military Air Transport Service.



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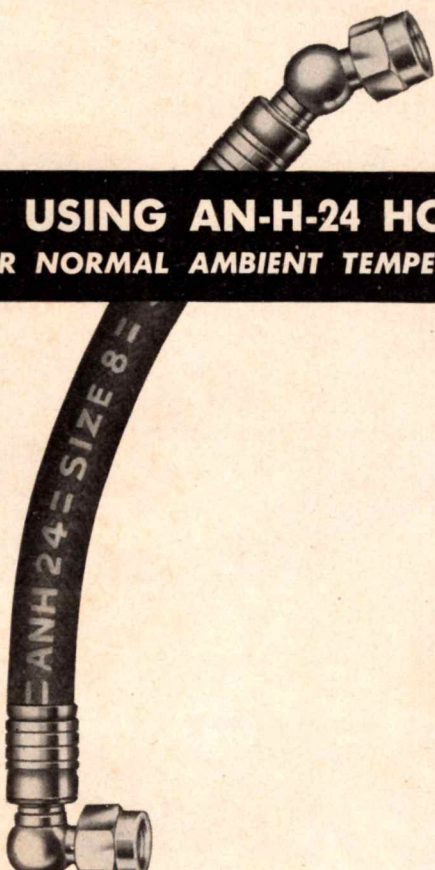
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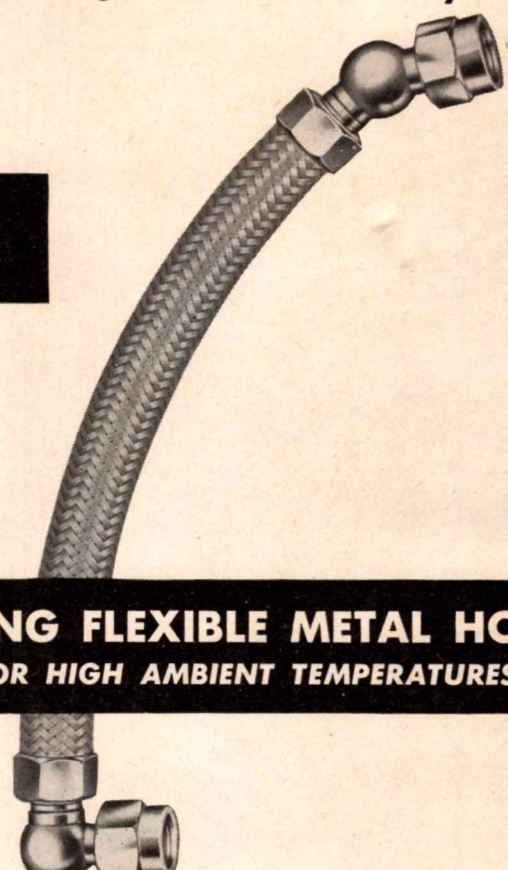
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FLEXIBLE PIPES with AVICA INTEGRAL ANGLE COUPLINGS

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FOR NORMAL AMBIENT TEMPERATURES.



USING FLEXIBLE METAL HOSE
FOR HIGH AMBIENT TEMPERATURES

AVICA Flexible Pipes using AN-H-24 1-wire hose; AN-H-28A 2-wire hose; or wire braid reinforced flexible metal hose can be supplied with AVICA Integral Couplings (patents applied for) in 6 angles from 90° to 165° inclusive, by 15 degree increments.

AVICA Flexible Metal Pipes withstand high ambient temperatures and are adaptable to all high, medium, and low pressure systems. They are suitable for jet engine fuel systems, fuel transfer lines and drain lines between the burner cans where high temperatures may be encountered.

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- SOLVE AWKWARD INSTALLATION PROBLEMS
- REDUCE INSTALLATION AND MAINTENANCE COSTS.
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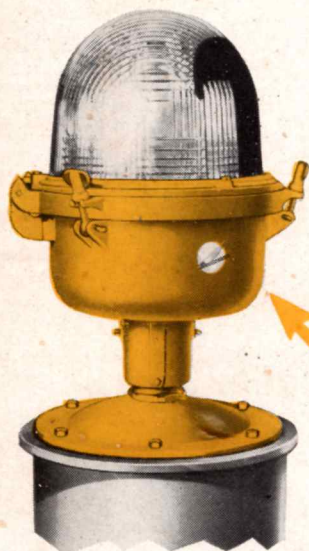
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of high intensity
airport runway lights



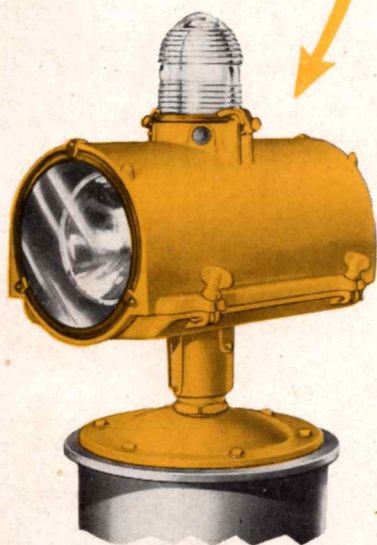
The Crouse-Hinds Company offers all three types of high intensity fixtures to meet the three CAA Specifications (L-818, L-819 and L-820). All three fixtures (types HRC, HIRL and HSL) are approved by CAA.

The Type HRC fixture utilizes a double prismatic lens system on a cast aluminum base, with a 500-watt, 115-volt lamp mounted on a movable socket. The main beams may be "toed in" or "toed out" by remote control from the tower to provide the best setting for particular visibility conditions. The candlepower is the highest of the three types. In bad weather the pilot sees more lights and sees them sooner with this system.



The Type HIRL fixture is constructed with a cast aluminum housing holding two aluminum reflectors for providing the main beams and three "zenith panels" for providing the necessary side light and overhead light. Each fixture uses a 200-watt lamp and is provided with a series to series insulating transformer installed underground in the base housing.

This system has the lowest installation cost, and for many airports its use is justified for non-instrument runways, as well as instrument runways. The lighter weight and lower height of this unit mean less hazard to aircraft.



The Type HSL fixture has a cast aluminum housing with two 95-watt sealed beam high intensity lamps inside and a 30-watt medium intensity light on top. Three insulating transformers are installed underground in the base. Each of the three lamps may be switched separately from the tower.

This system is economical to operate, since only 95 watts is used for the high intensity beam, and a 30-watt light is used in good weather. This fixture provides a main beam in only one direction, without the background haze resulting from the "back beam". After relamping, the sealed beam optical system is back to 100% initial efficiency.

All three fixtures provide the basic high intensity candlepower required and the three types have many construction features in common such as: cast aluminum housing, Pyrex glassware, disconnecting cable connector, same breakable coupling and standard steel base with base plate. All three units provide the necessary top light and side light needed for planes not on the approach path and all use a 5-stage brightness control.

Write for Bulletin 358-F. It contains detailed features and an impartial comparison of the relative advantages of the three systems with estimated installation costs of each.



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